EFFECTS OF EFFLUENTS FROM A COAL-FIRED, ELECTRIC-GENERATING

POWERPLANT ON LOCAL GROUND WATER NEAR HAYDEN, COLORADO

By Sherman R. Ellis and Phyllis G. Mann

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JAMES G. WATT, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

Colorado District Chief U.S. Geological Survey, MS 415 Box 25046, Denver Federal Center Lakewood, CO 80225

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METRIC CONVERSION FACTORS

Inch-pound units used in this report may be converted to metric SI (International System) units by using the following conversion factors:

Multiply	By	To obtain
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second
foot (ft)	0.3048	meter
foot per day (ft/d)	0.3048	meter per day
gallon (gal)	3.785	liter
gallon per minute (gal/min)	0.06308	liter per second
inch (in.)	25.40	millimeter
mile (mi)	1.609	kilometer

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called 'Mean Sea Level.' NGVD of 1929 is referred to as sea level in this report.

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ABSTRACT

Data were collected at the Hayden powerplant in northwest Colorado for about a year during 1978-79 to monitor the effects of effluent and raw-water storage ponds on the local ground water, Sage Creek, and the Yampa River. Ground water downgradient from the effluent ponds had average boron concentrations in excess of the Colorado Department of Health standard for agricultural use of water. The water from seeps located downgradient from the powerplant is probably the best indicator of downgradient water quality and had average concentrations of boron two times that of the Colorado Department of Health standard for agricultural use of water.

The Hayden powerplant uses seven principal ponds for the storage and disposal of effluents and raw water: An evaporation pond, an "intermediate-quality" pond, an "oil-skimmer" pond, a "high-quality" pond, two raw-water storage ponds, and a coal-pile runoff pond. Two theories may be used to explain the high boron content and high specific conductance of the water from wells and seeps downgradient from the evaporation, the intermediate-quality, the oil-skimmer, and the high-quality ponds. One theory is that all of the ponds are leaking; the other theory, suggested by Hayden powerplant personnel, is that a plume of ground water having high concentrations of boron and high values of specific conductance is responsible. This plume is the remnant of a plume resulting from the leakage of a fly-ash storage pond, which was converted to a raw-water storage pond in 1976. The data support the theory that the ponds are leaking or a combination of leaking ponds and the vestigial plume theory. The theory that a vestigial plume is responsible for the high boron content and high specific conductance of the water cannot be refuted.

It is estimated that about one-fourth of the flow past a representative cross section downgradient from the evaporation pond is leakage from the pond, and about three-fourths of the flow past a representative cross section downgradient from the intermediate-quality, the oil-skimmer, and the high-quality ponds is leakage from these ponds. Estimates of the amount of leakage from the ponds are based on the assumption that the ponds are the only sources of water high in boron.

Chemical analyses of water from wells and a ground-water discharge weir downgradient from the raw-water storage ponds indicate these ponds are leaking. The effect of this leakage is that the ground water downgradient from these ponds has a lower specific conductance and a lower boron concentration than the ambient ground water. The concentration of trace elements in the water from the wells and the discharge weir generally declined during the study, probably because of the decreasing effects of a plume from the raw-water pond previously used for fly-ash disposal.

The effluents from the Hayden powerplant lowered the specific conductance and the iron and manganese concentrations, increased boron concentration, and had little or no effect on the selenium concentration in Sage Creek. Sage Creek and the effluent from the Hayden powerplant had no discernible effect on the Yampa River because the volume of water in the Yampa River was so much greater than the volume of water in Sage Creek and the effluent from the powerplant.

INTRODUCTION

As of December 31, 1978, Colorado had 4,067.5 megawatts of electric-generating capacity. Of this capacity, about 76 percent was generated by the combustion of coal. In Colorado, the use of coal for generating electricity is expected to increase in the future as supplies of oil and natural gas decrease.

Associated with coal-fired, electric-generating plants are various environmental concerns, including fly ash, emissions from boilers, and effluents. The effluents, which include brines from water concentrators, cooling-tower blowdown water, and water that has been in contact with fly or bottom ash, commonly contain large concentrations of certain chemical constituents, including boron (Phung and others, 1979; Holland and Jones, 1978; and M. A. Hardy, U.S. Geological Survey, written commun., 1980). Evaporation ponds commonly are used to dispose of effluents; however, the effects of these ponds on the local ground water are not fully understood. Such an understanding is essential for the design of adequate effluent-disposal facilities at coal-fired, electric-generating plants.

The Hayden powerplant, located near the town of Hayden in northwest Colorado (fig. 1), owned and operated by the Colorado-Ute Electric Association, Inc., was selected as a site to study the effects of a coal-fired, electric-generating plant on the local ground water. Prior to April 30, 1976, effluents from the Hayden powerplant were discharged into Sage Creek, a tributary to the Yampa River. On April 30, 1976, discharge of effluents into Sage Creek ceased and effluents then were discharged into an evaporation pond. Studies done as part of the Yampa River basin assessment (J. W. Warner, U.S. Geological Survey, oral commun., 1980) indicated that ground water is discharging to the Yampa River in this area. Any water seeping from these ponds could possibly affect the quality and quantity of the local ground water. Thus, the ground water eventually could affect the water quality of the Yampa River.

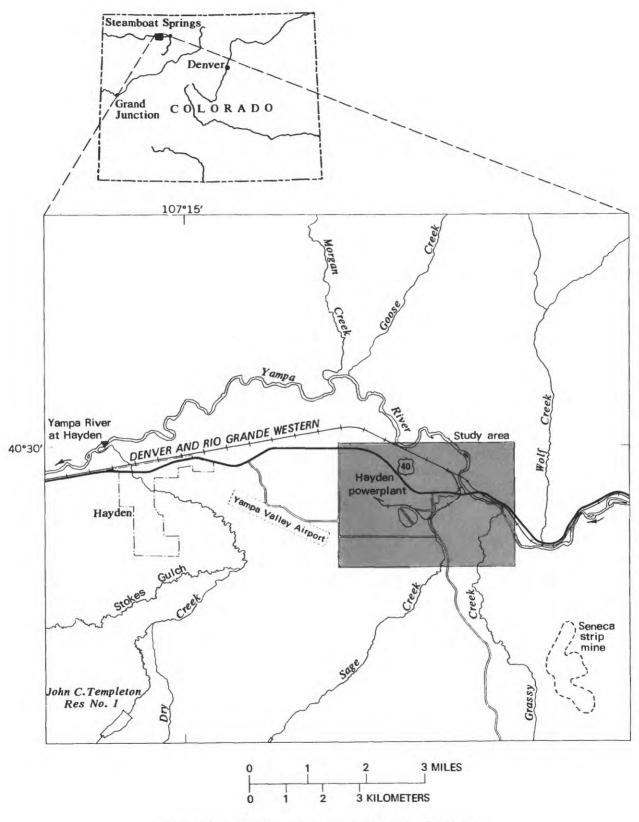


Figure 1.-- Hayden powerplant and local features.

Objectives

This study, which began in August 1978, was conducted by the U.S. Geological Survey for the U.S. Environmental Protection Agency. The objectives of the study were to: (1) Determine the ambient ground-water quality near the powerplant; (2) document the quality and quantity of effluents from the powerplant; (3) document the effect of boron on the ground water; and (4) determine the effects of the powerplant effluents on ground-water quality, quantity, and movement. The data and interpretation of data in this report may assist local agency planners, powerplant personnel, and designers to evaluate the effects of a coal-fired, electric-generating plant in semiarid areas with similar hydrology if the method of disposal of effluents is the same as the method used at the Hayden powerplant.

Acknowledgments

Appreciation is extended to Robert Heard, Environmental Field Supervisor, Hayden powerplant, for assistance in providing data on plant operations and in collecting data during the winter months. Colorado-Ute Electric Association, Inc., provided access to their property, permission to drill observation wells, and data on the plant site and land operation. F. R. Carpenter provided access to his property adjoining the Hayden powerplant and permission to drill observation wells on his property.

PLANT OPERATION

Construction of the Hayden powerplant began in April 1963. The first generator was placed in operation July 1, 1965, and a second generator was placed in operation September 1, 1976. The net generating capacity of the plant is about 450 megawatts. About 15 megawatts additional power is used in internal plant operations. About 5,000 tons of coal per day is supplied to the plant by the Seneca Mine (fig. 1), a strip mine located about 4 mi to the southeast.

The Hayden powerplant obtains its water supply from the Yampa River and has water rights for about 30 ft³/s. The location of the intake pumping station is shown on plate 1. Preliminary data supplied by the powerplant operators indicate that an average of 9 ft³/s is diverted from the Yampa River. Prior to November 1978, a single water-storage pond (raw-water storage pond no. 1) was used. A second pond (raw-water storage pond no. 2), used as a fly-ash disposal pond from 1965 to December 1974, was cleared of fly ash, lined with a 5-ft layer of locally obtained clay, and placed in operation as a water-storage pond during November 1978.

Prior to April 30, 1976, the plant discharged effluent into Sage Creek. In order to cease discharging effluents into Sage Creek, four principal ponds were built to the north of the plant. The ponds included an evaporation, an "intermediate-quality," a "high-quality," and an "oil-skimmer" pond (pl. 1). Construction of the ponds was started in late 1975, and they were placed in operation in April 1976. These ponds were lined with a 2-ft layer of locally obtained clay.

Two runoff-retention ponds (pl. 1) were constructed to retain surface runoff from the plant. Runoff-retention pond no. 1, located in a natural gully, receives local runoff from the northwest part of the powerplant. Runoff-retention pond no. 2 receives runoff via a small canal from the west side of the powerplant, where a scrap storage yard is located. The ponds are usually dry from late summer through winter and contain water only during the spring or early summer when surface runoff is above average. The runoff may be from either rainfall or snowmelt.

A preliminary water budget obtained from the Hayden powerplant operators is depicted in figure 2. This budget is based on older measurements that could not be updated or verified during this study because the flow gages in the control center had been rendered inoperable by a water overflow. It is known that about 9 ft 3 /s--not 6.28 ft 3 /s--of water is being withdrawn from the Yampa River and that 0.07 ft 3 /s of effluent is being discharged into the evaporation pond (Colorado-Ute Electric Association, Inc., oral commun., 1980). Although the budget is not up to date, the diagram approximates the relative flow rates of the water used in the powerplant.

A subsurface drainage system, formerly used to discharge effluent into Sage Creek, discharges ground water into Sage Creek. This system, referred to as the discharge weir in this report, is depicted on plate 1 as a 30-in. reinforced concrete pipe (RCP) drain ending in a discharge weir. Visual inspection of the system indicates that ground water seeps into the pipes and is present from a point opposite well HS-15 to the discharge weir at the mouth of the pipe. At present (1980), the only water discharged into the pipe system is ground water. The system probably is collecting water that has infiltrated from the raw-water storage ponds, the coal-storage and runoff-pond area, and local ground water.

An important part of the plant operation is the evaporation of wastewater from the evaporation pond. Two studies were conducted to determine the evaporation rates. The first study was conducted by a consulting firm before the pond became operational, and the second study was conducted by Hayden powerplant personnel in 1979. Both studies concluded that about 32 in. are evaporated each year; the average precipitation at Hayden is about 15 in. per year, resulting in a net evaporation of about 17 in. per year (Hayden powerplant personnel, written commun., 1980). The studies also determined that most evaporation occurs from June through September, and little or no evaporation occurs during the remainder of the year (fig. 3) due to ice cover of the ponds.

GEOHYDROLOGIC SETTING

The Hayden powerplant is located on an alluvial terrace, which is approximately 100 ft above the present flood plain of the Yampa River. This terrace, lowest of several alluvial terrace remnants which were formed by the downcutting of the Yampa River, extends about 4 mi to the south of the plant. Underlying the alluvium terrace is the Lewis Shale of Late Cretaceous age, a relatively impermeable formation that inhibits ground-water movement (pl. 2).

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Lat to Astronomy

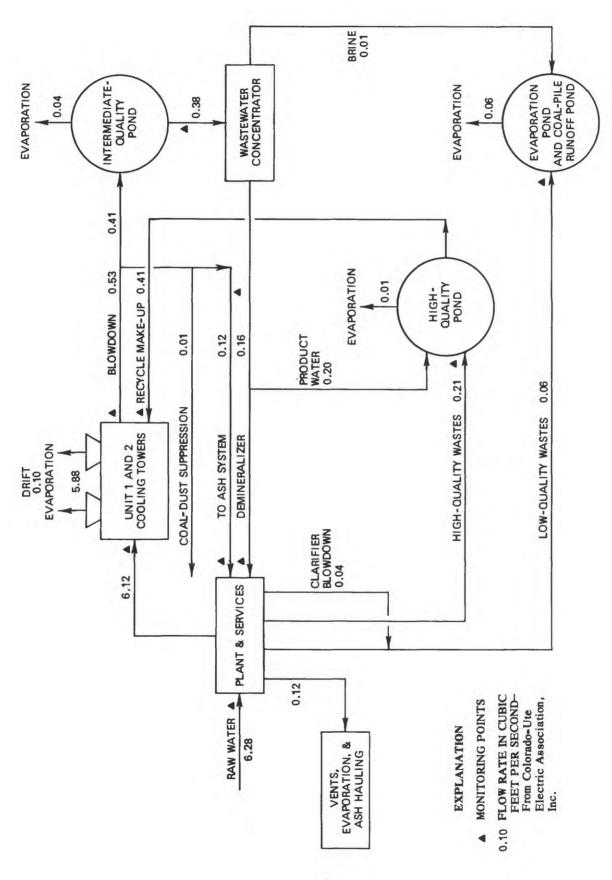


Figure 2 .-- Preliminary water budget of the Hayden powerplant. (Diagram supplied by Colorado-Ute Electric Association, Inc.)

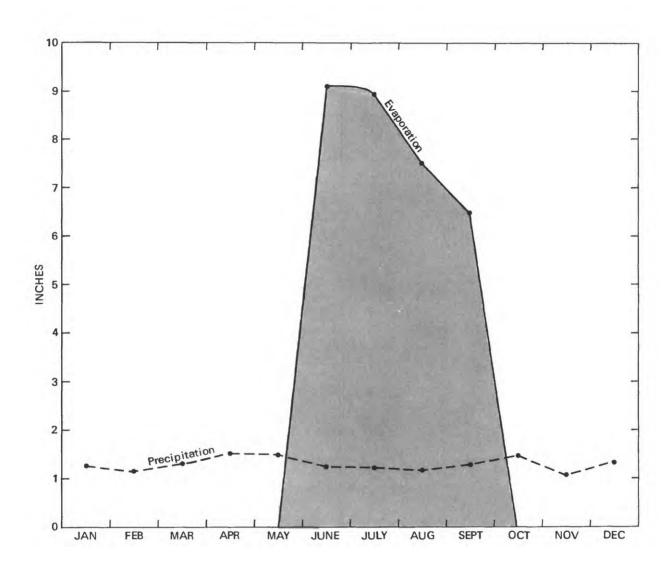


Figure 3.-- Monthly precipitation and evaporation at the Hayden powerplant. (From Colorado-Ute Electric Association, Inc.)

The terrace deposit is about 27 to 49 ft thick in the study area. The deposit is composed of alluvial sand and gravel and includes scattered thin layers of clay, caliche, and boulders. This alluvium supplies all of the well water because the Lewis Shale is not an aquifer in this area. Wells in the alluvium are used primarily for domestic purposes and yield less than 20 gal/min.

Seeps (pl. 1) may issue from the base of the alluvium where the stream has cut down into the Lewis Shale. Several seeps are present along the north and east faces of the terrace within 300 ft of the plant site. These seeps usually flow year round, but some go dry in late fall and winter. Information supplied by Hayden powerplant personnel and local residents indicates that the seeps were present prior to construction of the powerplant. However, residents claim that the discharge of the seeps has increased since the powerplant began storing effluents and Yampa River water in ponds.

DATA-COLLECTION NETWORK

Ponds

The Hayden powerplant uses seven principal ponds for the storage and disposal of effluents and raw water: The evaporation pond, the intermediate-quality pond, the oil-skimmer pond, the high-quality pond, raw-water storage ponds no. 1 and no. 2, and the coal-pile runoff pond. The evaporation pond is used for the storage of wastewater until it is evaporated. The evaporation pond receives wastewater from two sources--low-quality wastes from the powerplant and brine from the wastewater concentrator. The intermediate-quality pond receives blowdown water from the cooling towers and stores the water until it is recycled through the wastewater concentrator for reuse in the powerplant. The oil-skimmer pond is a small pond used to remove floating oil and grease from high-quality wastewater from the powerplant and high-quality water from the wastewater concentrator. The water from the oil-skimmer pond flows into the high-quality pond. The high-quality pond stores makeup water for use in cooling towers. The raw-water ponds store Yampa River water for use in the powerplant. The coal-pile runoff pond receives water only from precipitation and from runoff from the coal pile. The coal-pile runoff pond stores the water until it is evaporated. The location and interrelationship of these ponds are shown in figure 2 and on plate 1, except for the oil-skimmer pond, which is not shown in figure 2.

Powerplant personnel make weekly measurements of stage in the evaporation, the intermediate-quality, and the high-quality ponds. The fluctuations in water levels in the intermediate-quality and the evaporation ponds from October 1978 to January 1980 are illustrated in figure 4. The oil-skimmer and the high-quality ponds are connected by an underground pipe and therefore are at the same elevation. The stage of the high-quality pond was not measured during the winter when the pond was frozen. Because the intermediate- and the high-quality ponds are at about the same elevation, water-level data on the high-quality pond are not presented here, but are available at the Hayden powerplant.

5 5 4 4 10

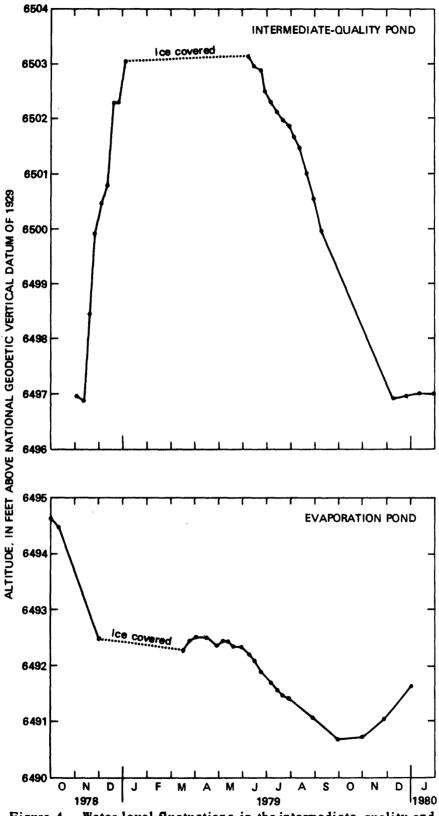


Figure 4.-- Water-level fluctuations in the intermediate-quality and the evaporation ponds, October 1978 to January 1980.

Water-quality samples were collected quarterly from December 1978 through October 1979 from all ponds except raw-water storage pond no. 2, which has the same source of water as raw-water storage pond no. 1. The initial samples were analyzed for a fairly complete set of trace elements and common constituents. The number of trace-element analyses was later reduced to include only those constituents whose concentrations tended to exceed the Colorado Department of Health (1977b) water-quality standards or were of local interest. The Colorado Department of Health (1977b) standards for uses of water are listed in table 1. The trace-element analyses subsequently performed included: Boron, iron, manganese, selenium, and zinc. Only two analyses for common constituents were made on water from the ponds. Results of all of the analyses are presented in the section on Water-Quality Data.

Wells

In order to determine any effects that effluents from the powerplant might have on the shallow ground water, 22 test wells were drilled near the plant (pl. 1 and table 2). Well HS-14 was drilled to provide information on the ambient ground water. Well HS-14 and one privately owned well completed in the alluvium, the Barnes well, were used as controls in the study. Well HS-14 and the Barnes well are not directly upgradient from the principal direction of natural ground-water flow beneath the plant, but lie to the west of the ground-water flow. Water in the wells is assumed to represent the ambient ground water because both wells receive water from the same alluvial fill as that upgradient from the powerplant. The other 21 wells were drilled downgradient from the plant and its storage ponds. The downgradient wells were used to monitor the effects of the plant and ponds on the quality and quantity of ground water.

Well HS-17 was found to have been drilled in an old spoils dump left over from plant construction. Although well HS-17 could not be used to monitor the effect of effluents from the plant, the analyses of water from the well did provide information on the influence of the dump on the local ground water. This well and the dump are not upgradient from any other monitoring well.

All 22 wells were drilled without fluids using a diesel hammer, reverse-air circulation Becker¹ drill. Each well was drilled through the alluvium 0.5 to 2 ft into the Lewis Shale. The wells then were cased with 3.25-in. outside diameter PVC pipe. The lower end of the casing was capped and the lowest 10 to 20 ft perforated. The wells were backfilled with gravel from the same alluvium in which they were completed. Each well was then sealed with cement and capped to prevent contamination from surface water. Levels were run for each well to determine the altitude above sea level.

¹The use of the brand name in this report is for identification purposes only and does not imply endorsement by the U.S. Geological Survey.

Water levels in all wells except the Barnes well were monitored for a year, from December 1978 through November 1979. The Barnes well has no access for measurement. Water levels were measured monthly to identify changes due to seasonal fluctuations, such as recharge from snowmelt and rainfall, pumpage from the aquifer, and the effects of lower pond levels. The water-level measurements are shown in table 2, and the water-level fluctuations in selected wells are illustrated in figures 5 and 6. Water-level contours at times of low-, medium-, and high-water levels are shown on plates 3, 4, and 5. The water-level contours tend to follow the outline of the evaporation, the intermediate-quality, and the oil-skimmer ponds, indicating a high ground-water level under these ponds. The shape of the water-level contours indicates the ponds are leaking, resulting in the elevated ground-water levels near the ponds.

Ground-water-quality data were collected quarterly from the test wells from December 1978 to October 1979. In addition, the Barnes well was sampled in June and October. Data from the Barnes well supplemented data from well HS-14 by providing additional information on the ambient ground-water quality. The initial samples were analyzed for a comprehensive set of trace elements and common constituents. The number of subsequent trace-element analyses was reduced to include only those constituents which exceeded the Colorado Department of Health (1977b) standards (table 1) or were of local interest. The trace elements analyzed for subsequent samples were: Boron, iron, manganese, selenium, and zinc. Two analyses for common constituents were made on the water from all wells, except the Barnes well, which had one analysis for common constituents made on the water from the well. Results of all these analyses are presented in the Water-Quality Data section.

Seeps

Seeps are present in the terrace cut along the north and east sides of the Hayden powerplant (pl. 1). Seeps occur for about three-quarters of a mile along the north face of the terrace. Eight representative seeps were chosen for water-quality sampling. All seeps except seep HS-8 are perennial. The seeps were developed by clearing the immediate area of vegetation, enlarging the outflow, and digging collection basins which were drained and allowed to refill prior to sampling. Estimates of flow were made prior to each sampling; these estimates were either visual or based on the time required to fill a given volume. The estimates may be in error because the seeps extend laterally.

Water-quality samples were collected from seeps HS-1 through HS-4 and the gravel-pit seep from January through October 1979 on a quarterly basis. Samples from seeps HS-5 through HS-7 were collected quarterly from March through October 1979, and samples from seep HS-8 were collected in March and June. Seep HS-8 was dry in October. The January samples were analyzed for nearly all trace elements, but subsequent analyses included only boron, iron, manganese, selenium, and zinc. The common constituents were analyzed during the January and March samplings and then discontinued. Results of the analyses and data on flow are presented in the Water-Quality Data section.

[From Wentz and Steele, 1980; value given is the maximum allowed, unless otherwise specified] Table 1.--Mater-quality standards for water use in Colorado

Temperature (°C) pH (standard units) Dissolved oxygen (mg/L) Chloride	Department of Health, 1977a) drinking-water regulations Physicochemical vi 56.5 <ph<8.5< th=""><th>Water supply¹ variables</th><th>Aquatic life²</th><th></th></ph<8.5<>	Water supply ¹ variables	Aquatic life ²	
Temperature (°C) pH (standard units) Dissolved oxygen (mg/L) Chloride	Physicochemical	ariables		Agriculture ³
Temperature (°C) pH (standard units) Dissolved oxygen (mg/L) Chloride	56.5 <ph<8.5< td=""><td></td><td></td><td></td></ph<8.5<>			
Magnes i um		65.0 <ph<9.0< td=""><td>⁴20 6.5<рн<9.0 76.0</td><td></td></ph<9.0<>	⁴ 20 6.5<рн<9.0 76.0	
Magnesium	Major inorganic const	constituents (mg/L)		
AluminumArsenicArsenic	8,91,4-2,4 810 5250 5250	125 250 91.4-2.4 10 250		10100
AluminumArsenic	Trace elements	(ng/L)		
Barium————————————————————————————————————	81,000 1,000 1,000 850 850 810 810	1,000 1,000 1,000 1,50 1,50 2 2 2 5,000	11100 50 10 121,000 1,000 1,000 50 50 50 50 50 50 50 50 50	100 750 100 200 200 200 200 200 5,000

	Organic c	Organic constituents (µg/L)		
	Chlori	Chlorinated pesticides		
Aldrin	8 8 9 8 9 9 9 9 8 9 9 8 9 9 9 9 9 9 9 9	3	0.003	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Chlordane		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	10.	t
Dieldrin		3 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	.003	1 1 1 1 1
		9 6 6 6 9 6 9	.001	1 1 1 1 1 1 1
Endrin	80.2	0.2	700.	1 1 1 1 1 1
Heptachlor			.001	1 1 2 2 1 1 1
Lindane	# C C	3	10.	1 1 1 1 1 1 1
Methoxychlor	8100	100	.03	1 1 1 1 1 1
Toxaphene	85	5	.005	
	Orthopho	Orthophosphate pesticides		
Demeton	1 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	9 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	-	1 1 1 1 1 1
Fudosul fan	1 1 2 1 1 1 1		003	1 1 1 1 1 1 1
Guthion	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1 1 1 1 1
Malathion				1 1 1 1
Parathion			7 0.	9 9 8 E
	-	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
		ier Dicides		
2,4,5-TP	810	100 10		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
		Other		
Polychlorinated				
biphenyl (PCB) Phenol			.001	
	Radiological	variables (pCi/L)		
Alpha	8,1315	1315	1315	1315
Cocium 12h-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-		350	05.	. 250
		15	5 5	5 22
	85	165	165	165
Strontium 90		861	80,	807
Tritium		20,000	20,000	20,000

Table 1.--Water-quality standards for water use in Colorado--Continued

Water-quality	National (U.S. Environmental Pro- tection Agency, 1976a; 1976b; 1977) and proposed Colorado (Colorado		Proposed Colorado water-quality standards (Colorado Department of Health, 1977b)	standards , 1977b)
70 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -	Department of Health, 1977a) drinking-water regulations	Water supply ^l	Aquatic life ²	Agriculture ³
	Biological variables	lables		
Fecal coliforms (per 100 mL)	8 = 1.7	18,190		181,000
	Miscellaneous variables	ariables		
Ammonia (mg/L as N)Chlorine (total residual:	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	200.5	210.02	! ! ! !
1/5m (7/5m	!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!	1 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	22.002	1 1 1 1
Cyanide (mg/L)	۲۶. ۲۶.	. 2	.005	0.2
roaming agents (mg/L) Nitrite (mg/L as N) Odor (threshold odor	6.	1.0	23.05	10
number)	53 5.05 81241	.05	.002	

Includes uncontaminated ground water and ground and surface water requiring disinfection or standard treatment (raw water).

²Includes cold-water biota (inhabitants, including trout, of waters where temperatures do not normally exceed 20°C) and warm-water biota (inhabitants of waters where temperatures normally exceed 20°C). Trace-element standards apply to waters having total hardness from 0 to 100 mg/L as $CaCO_3$; standards for waters of greater hardness may be equal or greater. Total trace-element concentrations are given, unless otherwise specified.

Includes irrigation and stock watering.

crease over a minimum 4-hour period lasting for 12 hours maximum from naturally occurring temperatures shall be "Applies only to cold-water biota; standard for warm-water biota is 30°C. In addition, a maximum 3°C inal lowed.

Secondary maximum contaminant level. These "* * are not Federally enforceable and are intended as guidelines for the States **** (U.S. Environmental Protection Agency, 1977).

7 Minimum allowed concentration. Applies only to cold-water biota; standard for warm-water biota is 5.0 mg/L. In addition, a 7.0-mg/L standard during periods of spawning of cold-water fish may be set on a case-by-case basis. ⁶Applies only to ground and surface water requiring disinfection or standard treatment (raw water).

⁸Interim primary maximum contaminant level. Applies to all systems providing piped water for human consump~ individuals." (U.S. Environmental Protection Agency, 1976a; 1976b). Proposed primary drinking-water regulations tion, "* * if such system has at least fifteen service connections or regularly serves at least twenty-five (Colorado Department of Health, 1977a).

temperatures for the location in which the community water system is situated * * *'' (U.S. Environmental Protec- 9 The exact fluoride standard applicable is dependent on "* * * the annual average of the maximum daily air

10 includes nitrite as N.

¹¹Refers to soluble form.

¹²Refers to total concentration.

13 Including radium-226, but excluding radon and uranium.

1411The average annual concentration of beta particle and photon radioactivity from manmade radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year." (U.S. Environmental Protection Agency, 1976b).

15 Excluding strontium 90.

16 Including naturally occurring or background contributions.

17 Arithmetic mean of all samples examined per month. In addition, when fewer than 20 samples per month are examined, no more than 1 sample shall exceed 4 per 100 mL; and when 20 or more samples per month are examined, no more than 5 percent of the samples shall exceed 4 per 100 mt (U.S. Environmental Protection Agency, 1976a). 18Geometric mean.

19Applies only to uncontaminated ground water with or without disinfection; standard for ground and surface water requiring disinfection or standard treatment (raw water) is 1,000 fecal coliforms/100 mL.

²⁰Proposed standard because of effect on chlorination.

 21 Nonionized. Applies only to cold-water biota; standard for warm-water biota is 0.10 mg/L.

²²Applies only to cold-water biota; standard for warm-water biota is 0.01 mg/L.

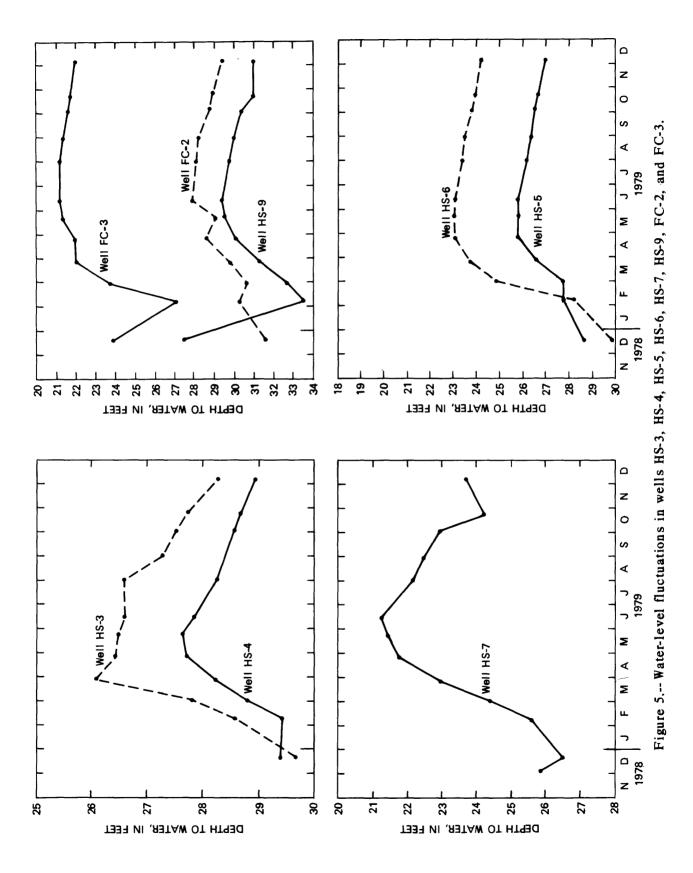
 24 A value of 5 or fewer TU is allowed if it does not interfere with disinfection or microbiological deter-23Applies only to cold-water blota; standard for warm-water blota is 0.5 mg/L.

²⁵Applies only to unconfaminated ground water.

Table 2.--Data on test wells drilled at the Hayden powerplant

	Dec. 4, 1979	33.7 32.8 28.0 28.9 27.0	24.1 23.7 18.3 31.1 33.0	30.1 25.1 29.4 34.7 31.2	25.0 14.5 28.4	24.1 29.5 22.1 28.3
	6761 ,22 ,±50	33.3 32.5 27.7 28.7 26.6	23.9 24.2 18.2 31.1	29.7 24.7 29.0 34.1 29.9	21.1 13.9 27.8	23.7 29.1 21.8 28.2
	.5-2 .3-0 1979	33.1 32.4 27.5 28.6 26.5	23.8 22.9 17.9 30.4 32.4	29.5 24.4 28.7 33.7 27.6	24.0 13.2 21.9	23.6 28.9 21.7 28.2
	6761 ,es .euA	32.8 32.2 27.3 27.4 26.3	23.5 22.5 17.4 30.0 31.9	29.1 23.9 31.0 33.1 29.3	23.9 13.1 27.3	23.3 28.3 21.5 28.0
(a)	6761 ,05 ylub	32.5 32.0 26.6 28.3 26.1	23.4 22.2 17.2 29.8 31.7	28.9 23.6 28.0 32.7 29.1	24.0 13.3 27.1	23.3 28.2 21.3 27.3
surfac	15° 1679	31.7 31.3 26.6 27.8 25.8	23.0 21.3 16.8 29.4 31.3	28.6 23.1 27.6 31.9 27.9	23.6 12.6 25.8	23.0 28.0 21.2 27.8
Water levels below land	6761 ,SS v.sM	31.5 31.2 26.5 27.6 25.7	23.0 21.4 16.8 29.5 31.4	28.6 23.1 27.4 31.9 27.5	23.4 12.1 25.5	23.0 29.2 21.4 27.8
Water levels (in feet below land surface)	e761 ,2S .7qA	31.3 31.0 26.4 27.7 25.8	23.0 21.8 17.2 30.1 31.9	29.1 23.9 28.4 33.2 26.5	22.4 12.2 24.8	23.5 28.7 22.0 27.7
in fee	,72-627, 1979	31.4 31.0 26.1 28.2 26.5	23.7 23.0 18.2 31.3 32.7	29.9 25.4 28.2 35.6 25.8	21.5 11.8 24.3	24.5 29.9 22.1 28.2
	676I ,I .ηδΜ	32.2 31.6 27.8 28.8 27.7	24.9 24.4 19.2 32.7 35.8	31.9 26.6 31.1 36.9 25.6	20.7 12.9 24.8	25.2 30.7 23.7 27.8
	Feb. 6, 1979	33.3 32.5 28.6 29.4 27.8	28.2 25.6 23.0 33.6 35.4	33.9 30.6 34.5 38.2 225.6	² 20.6 12.7. ² 26.1	27.5 30.4 27.1 28.1
	9791 ,11 .nst			38.2	24.3 13.8 229.9	
	Dec. 19-20, 1978	36.4 33.8 29.7 29.4 28.6	29.8 26.5 20.3 27.5 35.5	30.6 28.2 32.4 38.2 36.7	14.3	26.1 31.7 24.0 29.4
	Dec. 5, 1978		25.9	38.1		
Land- surface	(feet above sea level)	6,504.17 6,501.96 6,495.33 6,495.09 6,493.60	6,490.75 6,493.55 6,485.62 6,497.80 6,499.63	6,496.34 6,493.92 6,497.81 6,506.15 6,510.86	6,506.46 6,472.62 6,502.26	6,490.38 6,496.68 6,487.13 6,493.14
Depth	Lewis Shale (feet)	41 39 36.5 35 39.5	33.5 35.5 28.5 41	42.5 38 41.5 44.5	27 27 37	34 41 34 37
	Local well No. ¹	SB00608708CBD1 SB00608708CBD2 SB006087070AA2 SB006087070AA1 SB00608707ADC1	SB00608707ABC2 SB00608707DAB1 SB00608707ABC4 SB00608707ACD1 SB00608707ABB1	SB00608707ACC1 SB00608707DBC1 SB00608707DBC2 SB00608707DCC1 SB00608708CCD1	SB00608717BAA1 SB00608717BAA1 SB00608708CCD2	SB00608707ADC3 SB00608707ACD2 SB00608707ACD3 SB00608707AD1
	Latitude and longitude ^l	4029211071040 4029221071040 4029301071052 4029301071051 4029321071101	4029331071102 4029291071103 4029331071107 4029331071113 4029321071120	4029331071122 4029241071120 4029241071122 4029121071124 4029081071037	4028581071025 4029021071018 4029131071037	4029331071107 4029341071113 4029371071114 4029351071053
	well No.	HS-1 HS-2 HS-3 HS-4 HS-5	HS-6 HS-7 HS-8 HS-9 HS-10	HS-11 HS-12 HS-13 HS-14 HS-14	HS-16 HS-17 HS-18	FC-1 FC-2 FC-3 FC-4

¹See section on Systems of Locating and Numbering Wells and Springs.
²Water levels in wells HS-15, HS-16, and HS-18 reacting to filling of raw-water storage pond no. 2 in November 1978.



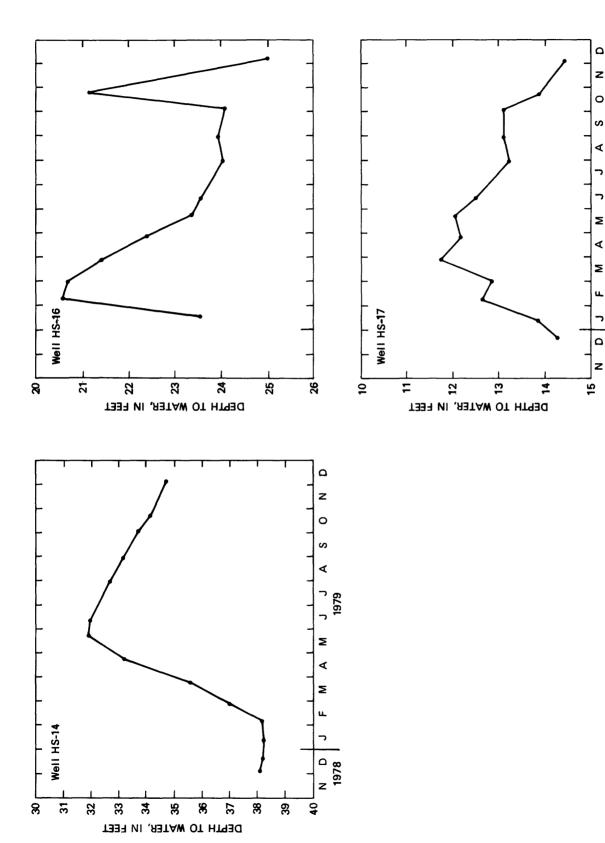


Figure 6.-- Water-level fluctuations in wells HS-14, HS-16, and HS-17.

Discharge Weir

The discharge weir is a concrete box containing a 90° V-notch weir used to measure the flow from the 30-in. RCP drain. The flow from the system, the largest single source of ground-water discharge in the area, is exceeded only by the combined flow from the springs along the lower (north) edge of the terrace. The average of four quarterly flow measurements made using the V-notch weir was about 0.40 ft 3 /s, varying seasonally from 0.26 ft 3 /s in January to 0.82 ft 3 /s in March. Water-quality samples were collected from January through October 1979 on a quarterly basis. The same general analysis schedule was used for samples taken from the discharge weir as was used for the wells and seeps. Results of the water-quality analyses and flow rates are presented in the Water-Quality Data section in this report.

Streams

Streams monitored in the Hayden powerplant study include the Yampa River near Hayden (U.S. Geological Survey streamflow-gaging station 09244410), Sage Creek above the Hayden powerplant, Sage Creek at U.S. Highway 40, and the Yampa River at Hayden, where one low-flow sample was collected. Sage Creek above the Hayden powerplant is an ephemeral stream, and the other streams are perennial. Flow rates for the Yampa River near Hayden were obtained from stage-discharge relations. Flow rates for Sage Creek above the Hayden powerplant were estimated using visual methods. Flow rates for Sage Creek at U.S. Highway 40 were estimated using the estimated flow of Sage Creek above the Hayden powerplant and estimates of inflows between the two sites. This method of estimating the flow for Sage Creek at U.S. Highway 40 was necessary because the site was located in backwater from the Yampa River. The same general scheme of water-quality sampling used for the wells and seeps was used for these surface-water sites. The results of the water-quality analyses and flow rates are presented in the Water-Quality Data section.

AMBIENT GROUND WATER

Data on the movement of the ambient ground water near the Hayden powerplant were sparse and insufficient. Most of the wells in the area are domestic and usually have no means of access for measuring the water level. Water levels are available only from drillers' logs and these levels are outdated. Surface topography is the main indicator of water movement and indicates that the ground water moves in a north-to-northwest direction, except near Sage Creek where it may flow northeast. Drillers' logs indicate that the maximum capacity of most wells is less than 20 gal/min, and that the majority of the wells yield 10 gal/min or less.

Data on the quality of ground water near the plant were insufficient to define the ambient ground-water quality. Analyses of water sampled from well HS-14 indicated concentrations of nitrite plus nitrate larger than 10 mg/L (milligrams per liter). Well HS-14 is downgradient from a wheat field and may receive recharge from the field. Although well HS-14 is downgradient from the coal pile and the raw-water storage ponds, analyses of water from the well indicate that the quality of water is not influenced by water from either the coal pile or the raw-water

storage ponds. Although the results of the analyses of other constituents probably are representative of the local ground water, a second control well--the Barnes well--was sampled in June and October for verification. The Barnes well (pl. 1) is a domestic well about 2 mi southwest of the Hayden powerplant. According to the drillers' log, this well penetrates the Lewis Shale, but it is screened in and receives all of its water from the alluvium.

Data from well HS-14 and the Barnes well were averaged in an effort to define the ambient ground-water quality. The averages were: Boron, 220 $\mu g/L$ (micrograms per liter); iron, 55 $\mu g/L$; manganese, 35 $\mu g/L$; selenium, 8 $\mu g/L$; zinc, 40 $\mu g/L$; and specific conductance, 1,050 $\mu mhos/cm$ (micromhos per centimeter). These concentrations do not exceed the Colorado Department of Health (1977b) standards for agricultural use of water, except for a sample from well HS-14 that contained 15 $\mu g/L$ of selenium. None of the concentrations exceeded the standards for drinking-water supply except for nitrite plus nitrate (which averaged 19 mg/L) and one sample containing high selenium (15 $\mu g/L$). Data from well HS-14 and the Barnes well are presented separately in the Water-Quality Data section.

Data on ambient ground-water quality were obtained from two additional sources and compared with the data from wells HS-14 and the Barnes well. The first source of data was a ground-water-quality study (R. S. Williams, U.S. Geological Survey, oral and written communs., 1981) in which 21 wells were sampled in the Grassy Creek valley, located about 1 mi east of the Hayden powerplant (fig. 1). The aquifer system in Grassy Creek valley is about the same as that near the Hayden powerplant; the aquifer consists of alluvial terrace deposits underlain by a relatively impermeable shale. Williams sampled 21 wells and collected 78 samples of water for analysis of boron, manganese, selenium, and specific conductance. The average values for the 21 wells were: Boron, 140 µg/L; manganese, 165 µg/L; selenium, less than 1 µg/L; and specific conductance, 1,470 µmhos/cm. The highest values were: Boron, 440 µg/L; manganese, 2,000 µg/L; selenium, 1 µg/L; and specific conductance, 3,400 µmhos/cm.

The second source of data on the quality of the ambient ground water was the computer data files of the U.S. Environmental Protection Agency and the U.S. Geological Survey. The area considered for retrieval of the data from the computer files was from south of U.S. Highway 40 to the southern boundary of the area shown in figure 1 and from longitude $107^{\circ}05^{\circ}00^{\circ}$ to longitude $107^{\circ}15^{\circ}00^{\circ}$. The computer data files had data on six wells not included in the Williams ground-water-quality or the Hayden powerplant studies. There was a variable number of analyses for each constituent. Boron was determined in three analyses; manganese, in six analyses; selenium, in six analyses; and specific conductance, in six analyses. The average values were: Boron, $141~\mu g/L$; manganese, $28~\mu g/L$; selenium, $5~\mu g/L$; and specific conductance, $1,500~\mu mhos/cm$. The highest values were: Boron, $284~\mu g/L$; manganese, $1,450~\mu g/L$; selenium, $7~\mu g/L$; and specific conductance, $2,950~\mu mhos/cm$.

An analysis of the data from the Williams ground-water-quality study and the computer data files indicates the data from well HS-14 and the Barnes well are an acceptable indicator of ambient ground-water quality in the area. None of the wells had analyses in which the boron exceeded the Colorado Department of Health (1977b) proposed water-quality standard of 750 μ g/L.

HAYDEN POWERPLANT EFFLUENT

Although a sample of the low-quality wastes was not obtained, one sample of Hayden powerplant brine effluent disposed of in the evaporation pond was supplied by powerplant personnel. The brine effluent sample, taken from the wastewater concentrator (fig. 2), was highly colored and contained flocculate after filtration through a 0.45-micron filter. An analysis indicated the following: Specific conductance, 75,000 µmhos/cm; carbonate, 240 mg/L; boron, 110,000 µg/L; iron, 1,700 µg/L; manganese, 37,000 µg/L; nickel, 300 µg/L; selenium, 220 µg/L; and pH, 6.2. The analytical dilution factor for selenium was 25; therefore, the value for selenium may be in error, even though several aliquots were analyzed and the average value reported.

Because we were able to obtain only one sample from the wastewater concentrator and no samples from the low-quality wastes, it is not known if this sample truly represents the inflow into the evaporation pond. However, it is the only available indicator of effluent quality.

EFFECTS OF BORON

Boron is of concern because it is a byproduct of coal burning and may be introduced into the local ground water by effluents from the Hayden powerplant. Whereas boron is important as a plant nutrient but is toxic to plants in high concentrations, a discussion of the occurrence, movement, effects, and recommended maximum levels is relevant. This discussion will be useful in assessing the effects of boron when the water is used for agriculture.

Boron usually is reported in terms of the element boron, and no effort is made to differentiate the species present. At the pH of natural water-less than pH 8.7--the predominant species would be H_3BO_3 (aqueous) and to a lesser degree, H_2BO_3 . At pH 8.2 the ratio of H_3BO_3 (aqueous) to H_2BO_3 would be 10:1 (Hem, 1970). Boron has been identified in several complex mineral forms; colemanite and kernite are two which are found in evaporate deposits in California and Nevada. Boron also is found in simple forms--calcium, magnesium, and sodium borates. Organic forms of boron also have been identified; they are the result of micro-organisms and plants utilizing boron in their growth. The organic forms of boron usually are oxidized to the inorganic form when the micro-organisms and plants die (U.S. Department of Agriculture, 1957). Boron in natural water does not seem to conform to a simple solubility constant but is probably controlled by several factors that are not well understood (Hem, 1970).

Movement of boron in the soil column is a complex procedure, involving pH, soil type, and organic matter (U.S. Department of Agriculture, 1957). Boron is readily adsorbed onto clays and to a lesser degree onto silts. Little or no adsorption occurs on sand. The type of cation has little or no effect on the rate or amount of adsorption. An increase in pH will increase adsorption and a decrease will lower adsorption. The effects of pH are reversible; that is, an increase in pH will increase the amount of boron fixed in the soil, and if acid is used to lower the pH, the amount of boron fixed in the soil will decrease. This reaction

is rapid and appears to be continuous. Organic matter appears to decrease the amount of boron fixed in the soil and release more boron into the water column to be available for uptake for life forms (U.S. Department of Agriculture, 1957).

Crops such as sugar beets, alfalfa, and clover are affected by a deficiency of boron in the soil. Boron is a necessary nutrient in the growth of legumes, especially alfalfa. Fertilizers that contain boron have been applied to crops for many years. The main results of boron deficiency are reduced growth, cellular change, and finally death. It is difficult to determine the amount of boron needed for growth by various plants because only a small fraction of the boron in the soil is in a form available for plant growth. Boron, as measured in the available form, is needed in concentrations of 0.5 mg/g (milligrams per gram) for satisfactory growth of alfalfa, sugar beets, red clover, and sweet clover (U.S. Department of Agriculture, 1957).

Boron, although a vital nutrient in plant growth, is a toxic substance when excess quantities are present. The problem of boron toxicity first became prominent during World War I, when potash salts, usually purchased from Germany, were mined from Searles Lake in California. Application of this potash resulted in damage to potatoes and vegetables. Analyses of the potash indicated that it contained more than 11-percent boron. The potash was then refined, the boron removed, and the problem was solved. Symptoms of boron poisoning are yellowish-brown spots on leaves (U.S. Department of Agriculture, 1957).

The problem of boron poisoning is not confined only to the application of fertilizer, but also to the application of irrigation water. Several plants, notably beans and fruit trees, are sensitive to boron. Crops such as alfalfa, sugar beets, clovers, and carrots are among the most tolerant crops. The relative tolerance of plants to boron in irrigation water is listed in table 3. The permissible limits of concentration of boron in several classes of water used for irrigation are shown in table 4. Irrigation water containing more than the recommended concentration of boron may not produce immediate harmful effects. Water containing as much as 2 mg/L of boron may be used on neutral and alkaline soils for some time without injury to sensitive plants. However, if the soils are acid, damage may occur rapidly [National Academy of Sciences and National Academy of Engineering, 1973 (1974)].

In Colorado, the maximum permissible limit of 750 $\mu g/L$ for boron has been established by the Colorado Department of Health (1977b) only for waters for agricultural use. Limits have not been established for water supply, aquatic life, or other uses.

Gastrointestinal and pulmonary disorders have been observed in lambs when the concentration of boron is unusually high in both the soil and water supplies. If large amounts of boron are ingested by humans, some serious toxic effects may be produced (Gough and others, 1979). More information is needed on the possible effects of boron before standards may be established for the permissible concentration of boron in water used for drinking and public supply.

Table 3. -- Relative tolerance of plants to boron

[In each group, the plants first named are the most tolerant and the last named are the least tolerant. From U.S. Department of Agriculture (1954)]

Tolerant	Semitolerant	Sensitive
Athel (Tamarix aphylla) Asparagus Palm (Phoenix canariensis) Date palm (P. dactylifera) Sugar beet	Sunflower (native) Potato Acala cotton Pima cotton Tomato	Pecan Black walnut Persian (English) walnut Jerusalem-artichoke Navy bean
Mangoes Garden beet Alfalfa Gladiolus Broadbean	Sweetpea Radish Field pea Raggedrobin rose Olive	American elm Plum Pear Apple Grape (Sultanina and Malaga)
Onion Turnip Cabbage Lettuce Carrot	Barley Wheat Corn Milo Oat	Kadota fig Persimmon Cherry Peach Apricot
	Zinnia Pumpkin Bell pepper Sweet potato Lima bean	Thornless blackberry Orange Avocado Grapefruit Lemon

Table 4.--Permissible limits for concentrations of boron in several classes of irrigation water

[Concentration of boron in mg/L. From U.S. Department of Agriculture (1954)]

Class of		For crops that are	
water	Sensitive	Semitolerant	Tolerant
Excellent	Less than 0.33	Less than 0.67	Less than 1.0
Good	0.33-0.67	0.67-1.33	1.0-2.0
Permissible	0.67-1.0	1.33-2.0	2.0-3.0
Doubtful	1.0 -1.25	2.0-2.5	3.0- 3 .75
Unsuitable	More than 1.25	More than 2.50	More than 3.75

EFFECTS OF EFFLUENTS

The effects of effluents from the Hayden powerplant on the local ground water are presented for five categories: Ponds, wells, seeps, the discharge weir, and streams. Data on the concentrations of trace elements in analyzed samples of water from the ponds, seeps, the discharge weir, and streams, and the number of samples which exceeded the Colorado Department of Health (1977b) standards for agricultural use of water are given in tables 5 and 6. Trace-element data are given in tables 7 and 8.

Ponds

The ponds at the Hayden powerplant can be classified as either effluent (evaporation, intermediate-quality, oil-skimmer, and high-quality) or raw-water storage (raw-water storage ponds no. 1 and no. 2). Because the coal-pile runoff pond was dry during most of the study period due to evaporation, it was not considered to have a major effect on the ground water. The relationship of specific conductance and boron with time for water in selected ponds is shown in figure 7.

The evaporation pond had the highest average specific conductance (6,590 μ mhos/cm) and the highest average boron concentration (4,800 μ g/L) of the five ponds sampled. Concentrations of these constituents varied greatly during the study. The October 1979 sample contained the largest values of specific conductance (13,800 μ mhos/cm) and boron (13,000 μ g/L). The December 1978 sample contained the smallest value of specific conductance (1,850 μ g/L).

A large discrepancy was found between the concentrations of selenium in the effluent entering the evaporation pond and in the water in the pond. The effluent contained 220 $\mu g/L$ of dissolved selenium (see page 21 for discussion of effluent sample), whereas the pond samples had a maximum concentration of 14 $\mu g/L$ and averaged 6 $\mu g/L$. The concentration of selenium in the pond decreased during the study. A sample of the bottom material from the evaporation pond analyzed for the following trace elements was found to contain: Boron, 560 $\mu g/g$; copper, 35 $\mu g/g$; manganese, 11 $\mu g/g$; selenium, none detected; and silver, 4 $\mu g/g$. The material was primarily fly ash, and material from the clay liner of the pond was not included. The analyses of the evaporation-pond water and the evaporation-pond bottom material (fly ash) did not indicate the presence of large amounts of selenium. The concentration of selenium in the downgradient wells was generally lower than in either the evaporation pond or the ambient ground water. Further study is needed to determine the fate of the selenium.

Seasonal evaporation, precipitation, and snowmelt will cause fluctuations in the quality of water in the evaporation pond. The water will probably reach its lowest annual concentration of constituents in early summer when runoff is greatest and reach its highest concentration in late summer. It is not possible to estimate the ultimate concentration of constituents in the evaporation pond, but the long-term trend is probably toward increasing concentration.

Table 5.--Average concentrations of selected trace elements in water from ponds, seeps, streams, and the discharge weir and the percentages as compared to the concentrations of the same elements in the ambient ground water

[NS=not significant; NA=not applicable; concentrations in microgram per liter, $\mu g/L$]

			· · · · · · · · · · · · · · · · · · ·	Trace	ele men	ts		
Site	В	oron	Se	lenium	Man	ganese	1	ron
	μg/L	Percent	μg/L	Percent	μg/L	Percent	μ g/L	Percent
Ambient ground water	220	100	8	100	35	100	55	100
Evaporation pond Intermediate-quality	4,800	2,200	5	NS	420	1,200	33	60
pond	1,800	820	3	NS	63	180	37	67
Oil-skimmer pond	1,800	820	6	NS	120	340	30	55
High-quality pond Raw-water storage	1,300	590	3	NS	73	210	40	73
pond no. 1	85	39	0	NA	30	86	230	420
Sage Creek at								
U.S. Highway 40 Sage Creek above	320	NA	57	NA	130	NA	100	NA
Hayden powerplant	250	NA	61	NA	740	NA	120	NA
Discharge weir	1,600	730	13	NA	130	370		
Gravel pit seep	1,200	550	2	NS	810	2,300	260	470
Seep HS-1	1,300	590	4	NS	12	34	70	130
Seep HS-2	1,400	640	6	NS	33	94	180	330
Seep HS-3	1,900	860	3	NS	33	94	130	240
Seep HS-4	1,800	820	6	NS	47	130	90	160
Seep HS-5	1,000	450	6	NS	5	14	5	9
Seep HS-6	1,600	730	2	NS	40	110	40	73
Seep HS-7	1,300	590	2	NS	15	43	40	73
Seep HS-8	1,300	590	4	NS	35	100	40	73
Yampa River								
near HaydenYampa River	72	NA	0	NA	40	NA	123	NA
at Hayden	80	NA	0	NA				

Table 6.--Number of samples of water from ponds, seeps, streams, and the discharge weir analyzed for boron and manganese compared with the number of samples exceeding the Colorado Department of Health (1977b) standards for agricultural use of water

Site	Number of samples		Number of samples that exceeded Colorado water-quality standards for agricultural use			
	Boron	Manganese	Boron	Manganese		
Evaporation pond	4	3	3	2		
Intermediate-quality pond	4	3	4	0		
Oil-skimmer pond	4	3	4	0		
High-quality pond	4	3	4	0		
Raw-water storage pond	·	•	•			
no. 1	4	3	0	0		
Seep HS-1	4	3	0	0		
Seep HS-2	4	3	4	0		
Seep HS-3	4	3	3	0		
Seep HS-4	4	3	3	0		
Seep HS-5	3	2	3	0		
Seep HS-6	3	2	3	0		
Seep HS-7	3	2	2	0		
Seep HS-8	2	2	1	0		
Gravel-pit seep	4	3	4	2		
Discharge weir	4	3	4	1		
Sage Creek above Hayden Sage Creek at	2	2	0	1		
U.S. Highway 40	3	2	0	1		

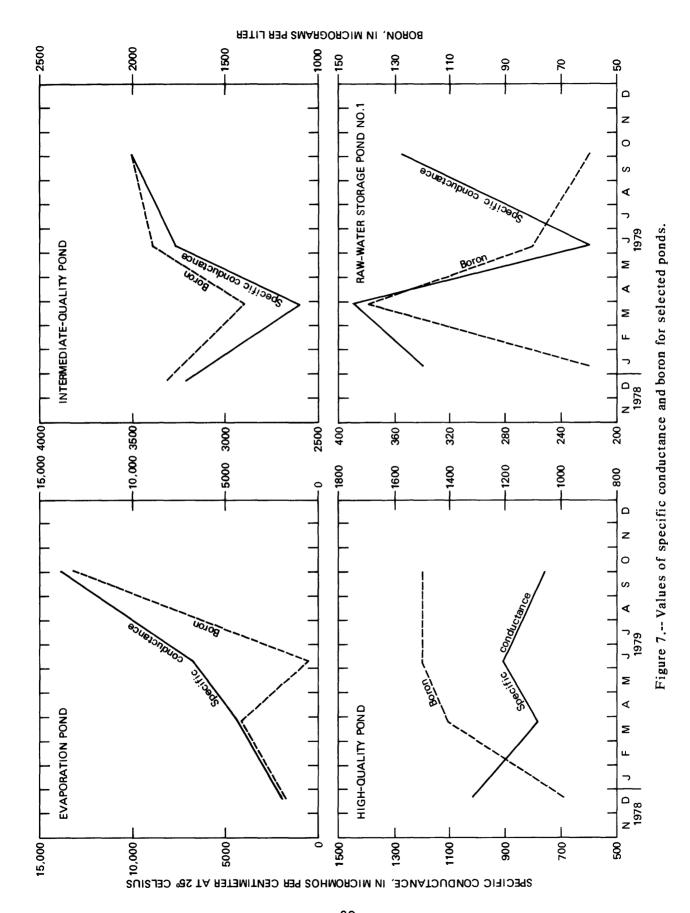
Table 7.--Average concentrations of selected trace elements in water from wells and the percentages as compared to the concentrations of the same elements in the ambient ground water

[NS=not significant; concentrations in microgram per liter, $\mu g/L$]

	Trace elements							
Site	Boron		Selenium		Manganese		Iron	
	μg/L	Percent	μ g/L	Percent	μg/L	Percent	μg/L	Percent
Ambient ground water	220	100	8	100	35	100	55	100
Well HS-1	960	440	4	NS	250	710	10	18
Well HS-2	1,000	450	4	NS	500	1,400	13	24
Well HS-3	1,200	550	1	NS	93	270	50	91
Well HS-4	1,200	550	1	NS	360	1,000	40	73
Well HS-5	1,500	6 80	2	NS	120	340	27	49
Well HS-6	1,200	550	3	NS	370	1,100	27	49
Well HS-7	1,100	500	4	NS	100	290	40	73
Well HS-8	1,600	730	4	NS	290	830	10	18
Well HS-9	1,700	770	5	NS	73	210	15	27
Well HS-10	1,300	590	6	NS	37	110	13	24
Well HS-11	1,000	450	5	NS	20	57	30	55
Well HS-12	1,800	820	10	NS	67	190	23	42
Well HS-13	1,600	730	10	NS	70	200	53	96
Well HS-15	670	300	3	NS	40	110	150	270
Well HS-16	2,700	1,200	12	NS	300	860	93	170
Well HS-17	510	230	3	NS	1,400	4,000	600	1,100
Well HS-18	960	440	4	NS	210	600	43	78
Well FC-1	1,700	770	3	NS	110	310	130	240
Well FC-2	1,700	770	6	NS	50	140	17	31
Well FC-3	1,800	820	6	NS	110	310	20	36
Well FC-4	1,200	550	2	NS	30	86	17	31

Table 8.--Number of water samples analyzed for boron and manganese compared with the number of samples exceeding Colorado Department of Health (1977b) for agricultural use of water from wells

Site	Number of samples		Number of samples that exceeded Colorado water-quality standards for agricultural use		
	Boron	Manganese	Boron	Manganese	
Well HS-1	4	3	4	1	
Well HS-2	4	3	4	1	
Well HS-3	4	3	4	0	
Well HS-4	4	3	4	2	
Well HS-5	4	3	3	0	
Well HS-6	4	3	2	2	
Well HS-7	4	3	2	1	
Well HS-8	4	3	3	1	
Well HS-9	4	3	4	0	
Well HS-10	4	3	4	0	
Well HS-11	4	3	3	0	
Well HS-12	4	3	4	0	
Well HS-13	4	3	4	0	
Well HS-14	4	3	0	0	
Well HS-15	4	3	1	0	
Well HS-16	4	3	3	1	
Well HS-17	4	3	0	2	
Well HS-18	4	3	3	1	
Well FC-1	4	3	3	0	
Well FC-2	4	3	4	0	
Well FC-3	4	3	4	1	
Well FC-4	4	3	2	0	
Barnes well	2	1	0	0	



The intermediate-quality pond had the most consistent water quality of all the ponds sampled. The average specific conductance was 3,140 μ mhos/cm and varied only by about 500 μ mhos/cm during the study. The average boron concentration was 1,800 μ g/L. The quality of the pond was adequate for raising trout. Of the trace elements sampled, only boron exceeded the recommended Colorado Department of Health (1977b) standard for agricultural use of water. Only two samples--one high in copper, the other high in zinc--exceeded the recommended Colorado Department of Health (1977b) standards for aguatic life.

The average specific conductance in the oil-skimmer pond (the smallest pond sampled) was 1,560 µmhos/cm, and the average boron concentration was 1,800 µg/L. Boron was the only constituent that was in excess of the recommended Colorado Department of Health (1977b) standards for agricultural use of water. Of particular interest was the October 1979 sample, which had a pH of 3.0; this value was verified by repeated measurements in the field and by analysis in the laboratory. The sample did not contain excessive amounts of any other analyzed constituent. The pH increased to about 6.0 the following day. It was subsequently determined that this increase was due to an incomplete construction modification resulting in demineralized wastes being periodically discharged into the high-quality pond via the oil-skimmer pond, resulting in severe pH fluctuations. The problem has since been corrected, according to Hayden powerplant personnel (written commun., 1981).

The high-quality pond had the best water quality of any of the ponds, as defined by the lowest values for specific conductance and boron. The average specific conductance of the pond water was 863 µmhos/cm and the average boron concentration was 1,400 µg/L. The pond contained high-quality effluents from the wastewater concentrator and from high-quality wastes. The water quality was relatively constant, deviating only slightly about the mean; for example, the deviation about the mean for specific conductance was about 150 µmhos/cm and for boron was about 400 µg/L. The October 1979 sample from this pond had the lowest pH--6.8--and was affected by the same factors that lowered the pH in the oil-skimmer pond. Large variations in water quality of the high-quality pond are not expected in the future unless there is a spill or the inflow is altered.

Raw-water storage pond no. 1 has about the same water quality as the Yampa River, its source. The water quality of the pond varies less than that of the stream because the larger storage capacity of the pond acts as a buffer. The average specific conductance of the pond was 326 $\mu mhos/cm$ and the average concentration of boron was 85 $\mu g/L$. The March 1979 sample from this pond had the highest concentration of boron--140 $\mu g/L$ --whereas the sample from the Yampa River had 60 $\mu g/L$. The reason for the difference is not known. No sample contained any analyzed constituent in excess of the Colorado Department of Health (1977b) standards for agricultural use of water.

Raw-water storage pond no. 2, which was used as a fly-ash disposal pond from September 1965 to late 1978, contained water of the same quality as raw-water storage pond no. 1 from December 1978 through October 1979. While pond no. 2 was being used as an ash-disposal pond, leakage probably resulted in a plume of leachate moving downgradient from the pond. The movement, extent, and quality of this plume are not known. The concentrations of boron and the specific conductance of water in the plume would have been higher than those in the ambient ground water,

but their values are not known. The plume would have caused boron to be adsorbed onto the clays and silts in the aquifer. Desorption of boron from the aquifer could have resulted in higher than ambient concentrations of boron in the ground water after the plume was probably displaced by leakage from the pond in late 1978.

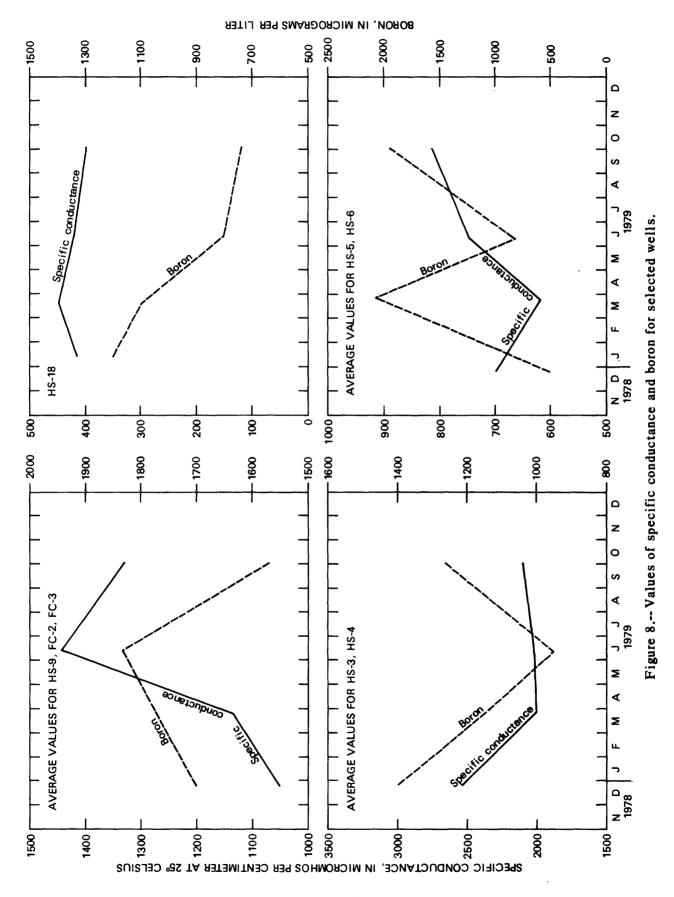
Hayden powerplant personnel (oral and written communs., 1980) stated that the plume of water which originated when raw-water storage pond no. 2 was used for fly-ash disposal is presently underlying the Hayden powerplant. They also stated that the values of specific conductance and concentrations of boron in the plume are about the same as the values of specific conductance and concentrations of boron in the evaporation, the intermediate-quality, the oil-skimmer, and the high-quality ponds. While the rate of movement of this plume is not known, the Hayden powerplant personnel suggest that it may take years for the remnants of the plume to dissipate from the area of the Hayden powerplant.

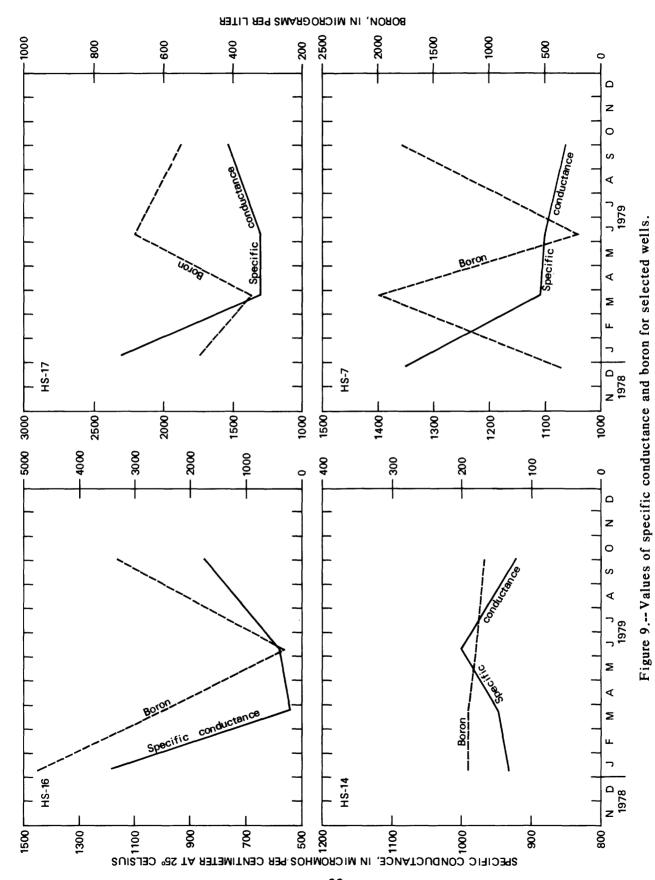
The coal-pile runoff pond contains water only during periods of local runoff. Because it is dry most of the time, it was not sampled.

Wells

Wells were placed near the Hayden powerplant to monitor the effect of the ponds on the ground water. Wells HS-1 through HS-6 and FC-4 were used to monitor the effects of the evaporation pond; wells HS-8 through HS-13 were used to monitor the effects of the intermediate-quality, the oil-skimmer, and the high-quality ponds; wells HS-15 and HS-16 were used to monitor the effects of the raw-water storage ponds; and well HS-18 was used to monitor the effects of the coal pile and the coal-pile runoff pond. The same groupings of wells are used in the discussion of how the movement and quality of water are affected by the powerplant. The relationships of specific conductance and boron with time in selected wells are shown in figures 8 and 9.

Analyses of the water from wells HS-1 through HS-6 and FC-4 downgradient from the evaporation pond determined the following water-quality parameters and their average values: Specific conductance, 1,220 µmhos/cm; boron, 1,200 µg/L; iron, 26 µg/L; manganese, 250 µg/L; and selenium, 3 µg/L. The concentrations of iron in water samples from wells HS-1 through HS-6 and FC-4 probably are not related to the concentrations of iron in the ambient ground water or the evaporation pond, but are related to the reduction-oxidation potential in ground water. In an oxidizing environment, iron ions will be precipitated; in a reducing environment, the ions can be leached from the surrounding soil or transported by the ground water. The concentrations of iron in the wells were lower than the Colorado Department of Health (1977b) agricultural water-use standard of 200 µg/L and generally declined during the study. The concentrations of manganese generally exceeded the water-use standard of 200 µg/L during the initial samplings and then declined to values lower than the standard during subsequent samplings. The water sample in well FC-4 had the lowest average concentration of manganese-30 µg/L.





The ground-water-flow system in the area of the evaporation pond is not a simple system receiving water only from the pond and ambient ground water. This is evident by the values of specific conductance of the water in wells HS-5 and HS-6 and, to a lesser degree, in wells HS-1, HS-2, and FC-4. The values at times were lower than those of either the evaporation pond or the ambient ground water. These anomalous values probably are due to local ground-water recharge from rainfall, snowmelt, runoff from the plant, or leakage from the raw-water storage ponds.

Analyses of water samples from wells HS-8 through HS-13 and FC-1 through FC-3 downgradient from the intermediate-quality, the high-quality, and the oil-skimmer ponds determined the following water-quality parameters and their average values: Specific conductance, 1,170 μmhos/cm; boron, 1,600 μg/L; iron, 34 μg/L; manganese, 92 μg/L; and selenium, 6 μg/L. All samples collected from wells HS-8 through HS-13 and FC-1 through FC-3 contained boron in excess of the Colorado Department of Health (1977b) standards for agricultural use of water, except for the December 1978 samples from wells HS-8 and FC-1 and the June 1979 samples from well HS-11. The lower concentrations of boron in these samples probably were due to recharge resulting from snowmelt and rainfall runoff. Well HS-11 is downgradient from runoff-retention pond no. 2, and during the June 1979 sampling period the pond contained water. Wells HS-8 and FC-1 probably receive local recharge from runoffretention pond no. 1. Analyses of water samples from wells HS-8 through HS-13 and FC-1 through FC-3 indicate that the intermediate-quality, the oil-skimmer, and the high-quality ponds were probably leaking. Boron concentrations in water from the wells were higher than in the ambient ground water and approached the concentrations of boron in the water from the ponds. The boron concentrations in the ground water downgradient from the intermediate-quality, the oil-skimmer, and the highquality ponds were therefore indicators the ponds were leaking.

Well HS-7 was drilled to monitor the effects of the evaporation, the intermediate-quality, the oil-skimmer, and the high-quality ponds. The average values of water-quality parameters for the water sample from well HS-7 were: Specific conductance, 1,160 $\mu\text{mhos/cm}$; boron, 1,100 $\mu\text{g/L}$; iron, 40 $\mu\text{g/L}$; manganese, 100 $\mu\text{g/L}$; and selenium, 4 $\mu\text{g/L}$. These results were compatible with the data on the wells monitoring the evaporation pond and the intermediate-quality, the oil-skimmer, and the high-quality ponds.

Wells HS-15 and HS-16 were drilled to monitor the effects of the raw-water storage ponds on the ground water. Raw-water storage pond no. 2 had been filled with fly ash prior to 1978, but was cleaned, reconditioned, and filled with Yampa River water prior to the January 1979 sampling. Before reconditioning, the pond probably recharged the alluvium penetrated by well HS-15 with water having a high specific conductance and a high boron concentration, possibly from the plume described previously. After the pond was filled with Yampa River water, infiltrate slowly leached boron from the soil, resulting in a lower boron level in the March, June, and October 1979 samples. This reduction in the concentration of boron in the water from well HS-15 will probably continue until the soil is in equilibrium with the raw water, which contains about $100~\mu\text{g/L}$ of boron. The Yampa River water infiltrating from the raw-water storage ponds also lowered the specific conductance of the water from well HS-15 to nearly that of the river water.

Well HS-16 did not react as quickly to the change in source of recharge as did well HS-15, probably because the aquifer penetrated is less permeable. Only about 4 ft of the aquifer is saturated, and this well yields less than 0.5 gal of water in 2 to 3 hours. The concentrations of boron in the water samples from well HS-16 have varied considerably, from 4,700 μ g/L in January 1979, to 300 μ g/L in June 1979, and to 3,300 μ g/L in October 1979. Probably the high level of boron in the January and October samples was due to seepage from the old fly-ash disposal pond or to boron being leached from the aquifer.

The concentrations of manganese in the water from well HS-16 generally decreased as the sampling progressed. The concentration of iron in the water sample from well HS-16 probably is related to a reduction-oxidation potential in the ground water, as explained in the section on wells HS-1 through HS-6 and FC-4. In the water from well HS-16, the average concentration of selenium (12 μ g/L) was higher than that in any other wells sampled. One-half of the samples from well HS-16 exceeded the Colorado Department of Health (1977b) standards for agricultural use and drinking water.

Well HS-17 was drilled in a spoils pile where coal and materials remaining from plant construction were buried. At present (1980), coal is buried upgradient, west of the well. Average values of water-quality parameters for well HS-17 were: Specific conductance, 1,620 μ mhos/cm; boron, 520 μ g/L; iron, 600 μ g/L; manganese, 1,400 μ g/L; and selenium, μ g/L. The water samples smelled of hydrogen sulfide (H2S) which is an indication of reducing conditions in the well. The H2S probably is derived from the decay of coal buried in the spoils pile. The pH of the water samples from this well remained constant at about 7.3--the lowest of any of the wells sampled. Well HS-17 probably is an indicator of the quality of ground water downgradient from the spoils pile and, therefore, cannot be used to define the ground-water quality in other areas.

Well HS-18 was drilled to monitor the effects of the coal pile and the coal-pile runoff pond. Average values of selected water-quality parameters for well HS-18 were: Specific conductance, 420 μ mhos/cm; boron, 960 μ g/L; iron, 43 μ g/L; manganese, 210 μ g/L; and selenium, 4 μ g/L. The value for specific conductance and the boron concentration suggest that the well is receiving recharge from a water source low in specific conductance and high in boron concentration in relation to the ambient ground water. Two possible sources of this recharge are leakage from the raw-water storage ponds and the coal-runoff pond. Because the boron concentrations decreased as the sampling progressed, and because the coal-runoff pond is dry most of the time, the source of recharge was probably leakage from the raw-water storage ponds.

The concentrations of selenium in water from well HS-18 were lower than in the ambient ground water and about the same or less than in water from the rawwater storage ponds. Concentrations of iron were less than 100 μ g/L and generally declined during the sampling period. The concentrations of manganese declined from 500 μ g/L during the January 1979 sampling, were not detected in the March sampling, and increased to 140 μ g/L in June.

Seeps

Water from seeps HS-1 through HS-8 and the gravel-pit seep are indicators of the quality of the ground water downgradient from the Hayden powerplant. The combined average values of the water-quality parameters for seeps HS-1 through HS-8 were: Specific conductance, 943 μ mhos/cm; boron, 1,500 μ g/L; iron, 88 μ g/L; manganese, 28 μ g/L; and selenium, 4 μ g/L. The gravel-pit seep is discussed separately because it contains H2S, a reducing agent; therefore, the trace-element chemistry of the water from this seep differs from that of the other seeps, which do not contain H2S. The relationship of specific conductance and boron with time in selected seeps is shown in figure 10.

Water from the seeps varied in quality. Water from seep HS-5 had the lowest average boron concentration (1,000 $\mu g/L$), seep HS-3 had the highest average boron concentration (1,900 $\mu g/L$), seep HS-5 had the lowest average manganese concentration (5 $\mu g/L$), and seep HS-4 had the highest average manganese concentration (47 $\mu g/L$). The average seep contained about seven times as much boron as did the ambient ground water. The average concentration of boron in the seeps is about two times the Colorado Department of Health (1977b) standard for agricultural use of water.

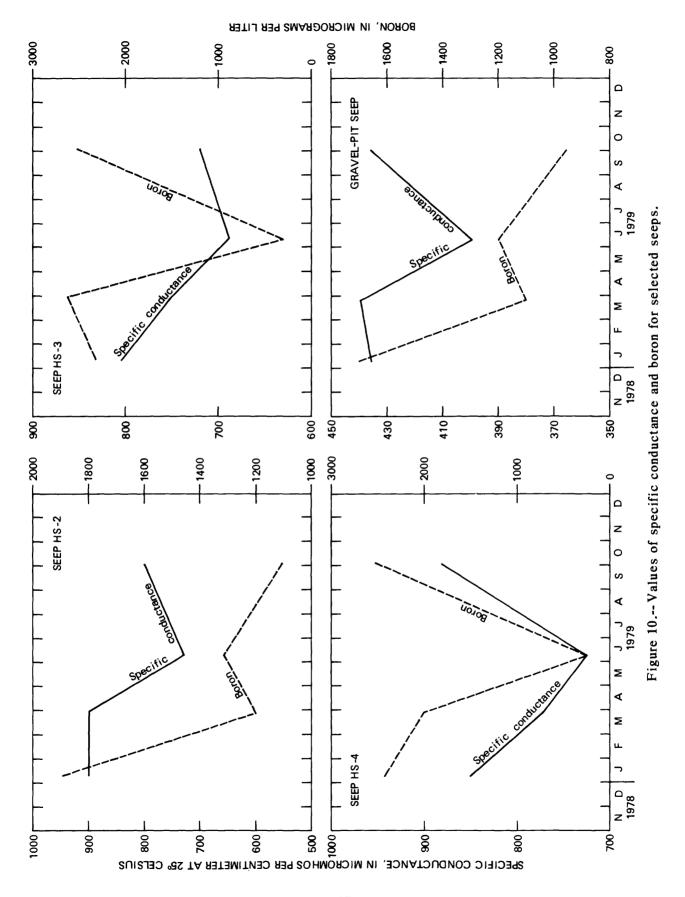
The gravel-pit seep smells of H_2S and locally is called a "sulfur spring." Two of the three samples from the seep contained manganese concentrations in excess of the 200- μ g/L standard (Colorado Department of Health, 1977b) for agricultural use of water. The concentrations of other trace elements are lower than the standards.

Discharge Weir

The discharge weir is probably reacting to the leakage from the raw-water storage ponds. The values for specific conductance and concentrations of boron, iron, manganese, and selenium declined by at least one-half from the January 1979 to the October 1979 samplings. The January samples contained 20 μ g/L of chromium, 15,000 μ g/L of iron, 21 μ g/L of nickel, 21 μ g/L of selenium, and 60 μ g/L of zinc, which were the highest concentrations from any sampling source in the study. The average values for the discharge weir were: Specific conductance, 900 μ g/L; boron, 1,400 μ g/L; manganese, 130 μ g/L; and selenium, 13 μ g/L. An average value for iron is not relevant due to the large variation between the January to June 1979 sampling.

Streams

Sage Creek above the Hayden powerplant, the upper of the two sites located on Sage Creek, was sampled in March and June 1979 and was dry during the other sampling periods. Sage Creek at U.S. Highway 40, the lower site, was sampled in March, June, and October 1979. Sage Creek at the upper site had a higher specific conductance than the lower site, averaging 3,300 μ mhos/cm versus 1,680 μ mhos/cm; higher manganese, 740 μ g/L versus 140 μ g/L; lower boron, 240 μ g/L versus 320 μ g/L;



higher iron, 120 $\mu g/L$ versus 70 $\mu g/L$; and about the same average value of selenium, about 60 $\mu g/L$. The March samples contained the highest concentrations of selenium collected at both sites on Sage Creek, 120 $\mu g/L$ at the upper site and 110 $\mu g/L$ at the lower site. These concentrations are about 11 to 12 times the standard for a water supply and 5 to 6 times the standard for agricultural use (Colorado Department of Health, 1977b). The selenium probably is not coming from the Hayden powerplant, but from some upstream source.

Water discharged from the Hayden powerplant affected Sage Creek by lowering the specific conductance and concentrations of iron and manganese; increasing the concentration of boron; and leaving the concentration of selenium essentially unchanged. Effluents from the powerplant entering Sage Creek had little effect on the Yampa River because the flow of Sage Creek averaged only about 0.2 percent of the Yampa River flow.

Four samples were collected at the streamflow-gaging station, Yampa River near Hayden, and one low-flow sample was collected for the Yampa River at Hayden. The Yampa River was sampled to determine the effects of the effluent from the Hayden powerplant on the river. The values of selected water-quality constituents at both sites were equal, within the error of analysis and sampling. Since low-flow conditions are the "worst case" in respect to the effect of effluents, at the present (1980), effluents from the Hayden powerplant are having no discernible effect on the Yampa River.

GROUND-WATER MOVEMENT AND QUANTITY

The direction of movement of the ambient ground water is not known but probably is about normal to the bedrock contours. The movement near the ponds can be depicted by drawing flow lines normal to the water-table contours. Ground-water flow lines in the immediate area of the Hayden powerplant for March 1979 are depicted on plate 6. The flow lines are, in general, normal to the downgradient sides of the ponds.

Empirical methods for estimating hydraulic conductivity, K, were used because boundary conditions near the observation wells precluded the use of aquifer testing by direct means. The method described by Robson (1978), which used an empirical correlation of particle grain size and sorting data obtained from core samples to estimate K, was applied to samples of the aquifer. The derived value of K was 6 ft/d. The value of K is about one-seventh the average value of K for sand and gravel aquifers (McWhorter and Sunada, 1977) but was within the range of values given for sand and gravel aquifers.

Two additional methods were applied to estimate K--the slug method and visual estimation by experienced personnel. In the slug method, a quantity of water is introduced into the well, the rate of decline of the water level in the well is measured, and K is estimated. The values of K obtained by these two methods ranged from 4 to 60 ft/d. The apparent difficulties in application of the slug and visual-estimation methods are the small diameter of the wells in relation to their depth, the wide range of particle sizes in the aquifer, and the horizontal layering of clay.

Because estimates of the K values ranged widely using these three techniques, the leakage rate from the evaporation pond could not be calculated. A chemical mass-balance equation was then used to estimate the proportion of ground-water flow downgradient from the evaporation pond that might originate as leakage from The data from March 1979 were chosen for the mass-balance equation because the local hydrologic conditions were relatively stable, and the water quality in the evaporation pond and downgradient wells were reasonably constant. The saturated thickness map was drawn (pl. 7) to verify the apparent stability of the ground-water flow downgradient from the evaporation pond, and the map showed no apparent flow discontinuities.

The following mass-balance equations were applied to estimate the leakage from the evaporation pond:

$$q_{ep} + q_{ug} = q_p, \tag{1}$$

and
$$B_{ep} x q_{ep} + B_{ug} x q_{ug} = B_p x q_p, \qquad (2)$$

where:

 $q_{ev}^{}$ =leakage from the evaporation pond, in cubic feet per second;

 q_{ua}^{-} =ambient ground-water flow, in cubic feet per second;

 $q_{_{\mathcal{D}}}^{^{-}}$ = flow past the downgradient face of the evaporation pond, in cubic feet

 B_{ep} =boron concentration in the evaporation pond, in $\mu g/L$;

 B_{uq}^{-} =boron concentration in the ambient ground water, in µg/L; and

 B_p =boron concentration in the ground water passing the downgradient face of the evaporation pond (the average of analyses from wells HS-3 and HS-4), in $\mu a/L$.

The following knowns:

 B_{ep} =3,900 µg/L, B_{ug}^{r} = 190 µg/L, and $B_{p}^{o} = 1,150 \text{ µg/L}$

are substituted in equations 1 and 2, which are then solved to yield:

Substituting into equation 1 yields:

$$q_{ep}^{+2.5q}_{ep}^{=q}_{p}^{-q},$$

$$3.5q_{ep}^{=q}_{p}^{-q},$$

$$q_{ep}^{=0.29q}_{p}.$$

According to the above results, the leakage from the evaporation pond is about one-fourth of the ground-water flow past the downgradient face of the evaporation pond. This calculation of leakage is subject to the following assumptions:

- 1. In the mass-balance equations:
 - a. Boron is a conservative tracer, and
 - b. The concentrations of boron in the water samples from the pond and well are the average concentrations present in the pond and aquifer.
- 2. The only source of boron higher in concention than the ambient concentratration is the pond upgradient from the flow section.
- The Lewis Shale is not a source of boron because it is not an aquifer in this area.

The same method and assumptions were used to estimate what percent of ground-water flow past a section along the north and west faces of the intermediate-quality, the oil-skimmer, and the high-quality ponds is leakage from the ponds. Calculations using the equations indicate that during the same period--March 1979--the entire flow through the section was leakage from the ponds. The concentration of boron in the March sample from the intermediate-quality pond (the largest pond) was the lowest of all the samples. The concentration of boron may have been low only for a short time when conditions were not average or stable. If the average concentration of boron was used in the calculations, then about three-fourths of the flow past the section would be leakage from the intermediate-quality, oil-skimmer, and high-quality ponds. To verify the results, October 1979 conditions were analyzed, and about three-fourths of the flow was calculated to be leakage from the ponds. Based on these data and calculations, the best estimate is that about three-fourths or more of the flow through the section is leakage from the ponds.

CONCLUSIONS

Water-quality data from the evaporation pond, the effluent inflow, and the bottom material indicate that the specific conductance and the concentration of boron in the evaporation pond probably will continue to increase and that the values of these parameters will fluctuate seasonally due to precipitation and evaporation. The only sample of the effluent disposed of in the evaporation pond contained a selenium concentration of about 220 $\mu g/L$. By comparison, the concentrations of selenium in the pond water, the bottom materials, or the downgradient ground water were less than 20 $\mu g/L$. Further study is needed to determine why these concentrations were drastically lower. The intermediate-quality, the oilskimmer, and the high-quality ponds were relatively stable with respect to water quality and will probably remain so unless the inflows are changed chemically. The raw-water storage ponds reflect the water quality of the Yampa River, which is their source, and provide water low in boron concentration and low in specific conductance to the local ground water.

Analyses of the quality of water from the observation wells downgradient from the Hayden powerplant indicate that concentrations of boron in the ground water downgradient from the effluent ponds have increased to an average concentration that exceeds the Colorado Department of Health (1977b) standards for agricultural use of water. The boron concentration in water from wells HS-1 through HS-13 and FC-1 through FC-4 probably will not decrease below these standards in the near future.

Data from wells HS-15, HS-16, and HS-18 indicate the raw-water storage ponds are leaking. This leakage is resulting in boron concentrations of less than 500 μ g/L, except in well HS-16 where less than 4 ft of the aquifer is saturated, and the water movement apparently is slower than at the other monitor wells. The trend for these concentrations is to decrease as the boron is leached from the unsaturated zone below the ponds.

Water from nine sampled seeps are the best indicators of the quality of the ground water downgradient from the Hayden powerplant. The average concentration of boron in the water from these seeps was 1,500 $\mu g/L$, about two times the Colorado Department of Health (1977b) standard for agricultural use of water. Concentrations of boron in the seeps vary seasonally, being lowest during the spring (highest recharge), and highest during the fall and winter (lowest recharge).

The discharge weir, which was in use until 1976 as part of a system to dispose of effluents, is now discharging ground water that is recovering from the effects of the effluents. The concentrations of selected trace elements in the water generally declined during the study. This decrease in the concentration of trace elements probably will continue, because the raw-water storage ponds are the major source of recharge to the ground water discharging over the weir. The discharge weir is also the largest single ground-water discharge point downgradient from the Hayden powerplant. The average flow over the weir is about 0.40 ft³/s.

The effect on Sage Creek of the effluents from the Hayden powerplant was to lower the specific conductance and the concentrations of iron and manganese, to increase the concentration of boron, and to leave unchanged the concentration of selenium, as compared to the upstream water quality of Sage Creek. Sage Creek above the Hayden powerplant contained a high concentration of selenium during the March sampling--120 $\mu g/L$, 12 times the standard for a water supply and 6 times the standard for agricultural use (Colorado Department of Health, 1977b). This selenium probably is not coming from the Hayden powerplant, but from some upstream source.

The Yampa River near Hayden (above the powerplant) and Yampa River at Hayden (below the powerplant) were sampled in October during low flow. Analysis of the samples indicates that effluents from the Hayden powerplant had no discernible effect on the Yampa River, due to the large volume of the Yampa River in relation to the volume of effluents from the Hayden powerplant.

Two theories may be used to explain the high boron content and the high specific conductance of the water from wells and seeps downgradient from the evaporation, the intermediate-quality, the oil-skimmer, and the high-quality ponds. One theory is that all of the ponds are leaking; the second theory, suggested by the Hayden powerplant personnel (oral and written commun., 1980), is that a plume of contaminants has resulted from leakage of raw-water storage pond no. 2 when it was used for fly-ash disposal. The second theory also explains the high boron content and low specific conductance of the water from wells HS-15 and HS-18.

The concept of the leaking ponds or the plume theory can both be supported by water-quality data from wells downgradient from the evaporation, the intermediatequality, the oil-skimmer, and the high-quality ponds. The water-level contours near these ponds tend to conform to the shape downgradient from the ponds, with a higher ground-water level nearest the ponds. Therefore, those water-level contours tend to support the concept that the ponds are leaking. The specific conductance in water samples from wells HS-15 and HS-18, which are downgradient from the rawwater storage ponds, declined during the study to a value near the specific conductance of the water in the raw-water storage ponds and to about one-half the value in the ambient ground water, which indicates that the raw-water storage ponds are leaking. The raw-water storage ponds and the evaporation, the intermediate-quality, the oil-skimmer, and the high-quality ponds are lined with the same type of locally obtained clay and are of similar construction. The raw-water storage ponds are lined with 5 ft of clay, and the evaporation, intermediate-quality, oil-skimmer, and high-quality ponds are lined with 2 ft of clay. If the raw-water storage ponds are leaking, the conclusion is that all ponds probably are leaking.

Data from wells HS-15 and HS-18 indicated decreasing values of specific conductance and concentrations of boron in the ground water downgradient from the raw-water storage ponds. This tends to support the concept of a remnant plume of water high in specific conductance and high in boron concentrations moving downgradient from the raw-water storage ponds. That is, if the raw-water storage ponds were leaking during 1978 and 1979, they were probably leaking when raw-water storage pond no. 2 was used for fly-ash disposal, resulting in a plume with high specific-conductance values and high boron concentrations.

Seep HS-8 was dry in October 1979 which was interpreted by Hayden powerplant personnel as an indication of minimal leakage from the intermediate-quality pond. Seeps HS-3 and HS-4, also downgradient from the intermediate-quality pond, were not dry during October 1979 and had concentrations of boron of 2,500 $\mu g/L$. The October flows and high concentrations of boron of seeps HS-3 and HS-4 indicate that the leakage from the intermediate-quality pond may be significant. The data for seeps HS-3, HS-4, and HS-8 during October 1979 is, however, inconclusive to quantitatively define leakage from the intermediate-quality pond.

Flow rates were calculated using a mass-balance equation to obtain the percent of the ground water leaking from the ponds. Calculations using the mass-balance equations were based on the assumption that the ponds were the only source of water containing high concentrations of boron. About one-fourth of the flow past a section downgradient from the evaporation pond was computed to be leakage from the pond. About three-fourths of the flow past a section downgradient from the intermediate-quality, the oil-skimmer, and the high-quality ponds was computed to be leakage from the ponds.

Although both theories can be used to explain the high concentrations of boron and the high values of specific conductance, the available data tend to support the leaking-ponds theory or a combination of the leaking-ponds and plume theories. To completely isolate the effects of the pond leakage from the plume would require further study, which would require the drilling of additional wells upgradient of the powerplant and wells between the raw-water storage ponds and the other ponds. In addition, hydraulic conductivity and porosity of the alluvium must be determined to facilitate reliable estimates of leakage rates from the ponds and the rate of movement of the plume.

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SYSTEMS OF LOCATING AND NUMBERING WELLS AND SPRINGS

Two systems are used to locate and number wells and springs. One system (fig. 11) uses the 14-character code of the U.S. Bureau of Land Management's landsubdivision system. The first character is an S, which indicates that the well or spring is located in the area covered by the Sixth Principal Meridian. The next letter denotes the quadrant formed by the intersection of the base line (parallel) with the principal meridian. The quadrants are designated A, B, C, or D in a counterclockwise manner with the northeast quadrant being A. The first three numbers designate the township, the next three designate the range, and the last two designate the section. Each section is then divided into quarters designated A, B, C, or D in a counterclockwise rotation, with the northeast quarter being A. This is done again for the quarter-quarter section and the quarter-quarter sec-The three letters following the number designation of township, range, and section indicate the well or spring position first in the quarter section, then in the quarter-quarter section, and then in the quarter-quarter-quarter section. The final number is the order in which the well or spring in the designated quarterquarter-quarter section was inventoried. A well or spring numbered SB00608717BAA1 would be the first one located in the NWANEANEA sec. 17, T. 6 N, R. 87 W.

The second system is a 15-digit number derived from latitude and longitude. The first six digits represent degrees, minutes, and seconds of latitude, and the next seven digits represent degrees, minutes, and seconds of longitude. The remaining two digits indicate the sequence in which wells or springs with the same latitude-longitude designations were inventoried.

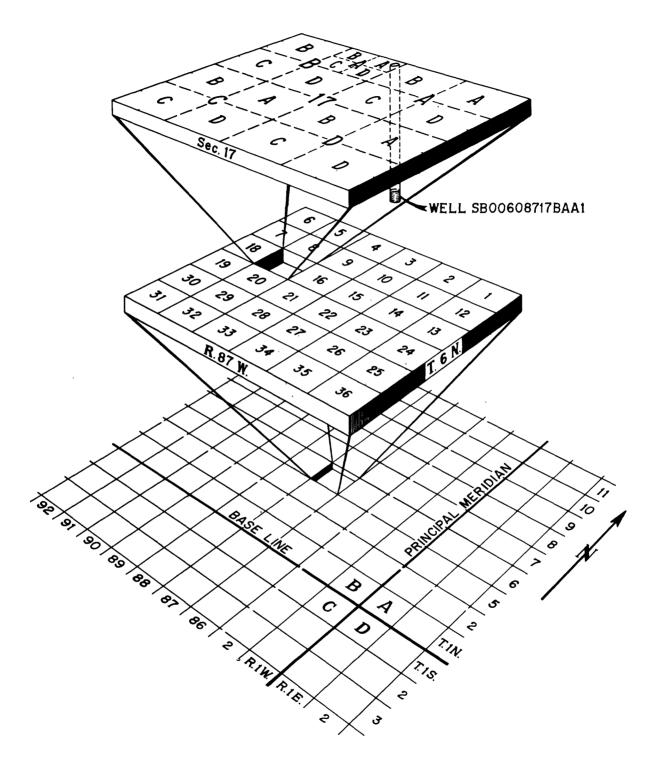


Figure 11.- Diagram showing system of locating and numbering wells and springs.

WATER-QUALITY DATA

47 Next page 12 49

[DEG C=degree Celsius; CFS=cubic foot per second; MICROMHO=micromho per centimeter at 25° Celsius; MG/L=milligram per liter; UG/L=microgram per liter; TON PER AC-FT=ton per acre-foot]

	MG/ L=m1	iligram pe	r liter; t	G/L-micro	gram per i	iter, ion	FER ACTI	-con per a	cre root;	
		TEMPER-	AGENCY AN1- LYZING SAMPLE	SPE- CIFIC CON- OUCT- ANCE	ън	CARBON DIOXIDE DIS+ SOLVED	44KA+ LIMITY (MG/L	HICAH- HICAH- HOMATE HOME)	NITRO- GEN. NOZ-NO3 DIS- SOLVED	PH03- PH4TE, OPT-0. OIS- SOLVED
	TIME	ATUPE	(CODE)	(MTC30-		(MG/L	45	AS	(MG/1_	(467)
DATE		(DEG C)	NO (BER)	4HD<)	(UNITS)	45 CO2)	C4C03)	4C03)	AS N)	43 P)4)
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JUN 12	1535	14.0	80020	1000	7.6	13	560	320	20	
03	1130	11.0	80020	925	7.5	••	360	••		
	P405- PHO-U5•	PHOS- PHORUS: OR (HO:	-05A+	H470-	CALCIUM	MAGNET Slum.	\$001UM+	\$00 IUM AU-		POTAS- S (UM+
	DIS- SOLVED (MG/L	OIS- SOLVED (MG/L	NESS (MG/L 45	HONCAR- BONATE (MG/L	DIS- SOLVED (MG/L	015- SOLVEU (MG/L	OTS-	_<802 (01749 01749	Sen (UP	015 - SOLVED (MG/L
STAC	AS P)	45 P)	CACO3)	CACO3)	45 CA)	45 4G)	AS NA)	74110	PERCENT	AS AT
JAN + I										
11	.040	.00	320	ŋ	64	40	90	٤.2	37	3.0
717N 56	.010	.01	360	29	13	43	90	2.1	.15	3.9
12			••							
0CT				••						
0412	CHLO- RIDE, DIS- SOLVED (4G/L AS CL)	SULFATE DIS- SOLVED (NG/L AS SO4)	FLUO- PIDE+ DIS- SOLVED (MG/L AS F)	SILICA, DIS- SOLVED (MG/L AS SIJ21	APSENIC 715- 80LVE0 (UG/L 45 AS)	8080N, 015- 50LVEU 8080N,	CARMIUM DIS- SØLVER (UGZL AS CO)	CHRO- MIUM. DIS- SOLVED (MG/L AS CR)	CUPOFIS, DIS- SCLVFD (UGZ) AS CU)	IPON+ - 015- 5067EJ (1967E AS FE)
JAN + I										
11 MAR	52	96	.7	16	1	190	2	Ü	3	20
25	23	110	.8	15		190	**	0		170
12 OCT			••			160				10
03				••		170	~ ~	10	es 49	•
04	50 <u>1</u> (06	0. NES S+ 01 VEO SHL	5- 015 VED 50L VL (UG	- 01 VED 50L VL (HG	S- 01 VED SOL /L (115	M. SEL S- NIU VEO TOT VL (UG	MA THEM AL OF	0F SOLI TI= 01 TS+ SOL S= (FU VED PE	S= MERC 7ED OT 45 SOL 4 (UG	S- VEG /L
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150 150	• • •	••	10		••	15				••
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WATER-QUALITY DATA FOR BARNES WELL, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	O O MPER- A ATURE (*	PE- IFIC ON- UCT- NCE ICRO- HOS) (U	PH (f	LKA- PH NITY F NG/L S NS F	DIS- SOLVED MG/L		NONCAR- HONATE (MG/L	ALCIHM DIS- SOLVED (MG/L AS CA)	MAGNE- SIGH+ SIGH- SOLVED (MG/L AS MG)
JUN • 1979	9 1345	12.0	1460	8.3	290	.030	630	340	140	57
03	1710	15.0	1000	7.6	250					
DATE JUN + 13 OCT 03	. 1.8	RIDE, 0 (3- 0 (3- 0 SOLVED (MG/L AS CL)	(MG/L	FLUO- RIDE; OIS- SOLVED (MG/L 4S F)	SILICA. DIS- SOLVED (MG/L AS SIU2)	ARSENIO OIS- SOLVEI UUS/L AS AS	715- 0 Souvi (UG/U) AS 33	OTS- ED SOLVE (UG/L) AS CD	0.15= 0.50LV (0.97) 45.0	• En L
DATE	COPPER DIST SOLVED (UG/L AS CU)	OIS- SOLVED (UG/L	(UG/L	MANGA- NESE+ OTS- SOLVED (UG/L AS: MN)	NICKEL, DIS- SOLVED (YG/L AS NI)	OIS- SOLVE: (UGZL	(1)371	CONSTI	- MERCH • DTS SOLV D CHGZ	- dD L
JUN • 13••, OCT 03••,				10	5			2 74 1 -	-	.0

WATER-QUALITY DATA FOR EVAPORATION POND, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE DEC + 1971	TEME	TEMP(ATHI (DEG	RE (C	00:00 PLE APP 00:00 PLE APP 00:00 PLE (MI)	FIC != CT- CE CHU+	010 0 PH 50 (M	LVED G/L	ALKA- INITY (MG/L AS CACO3)	RICAR BONAT (MG/ AS HC03	66 - 102 E U) E SO(EN+ PH + v03 OR: LS=	05- AFE: THO: F IS- LVEU S/L P04)	PHOS= HORUS: DIS= SULVED (MG/L AS P)
22	1345		÷	0020	1850	7.6	2,4	49		60	.59	.00	.210
MAR . 1979	1500		4.0 8	0020	·200	7.1	~-	11]	1.2	.00	.150
JUN	24.00					_				n.e			
12	1600	2	4.0 d	0020	5500	8.7	•1	21		26			~-
02	1515	1	2.5 8	0020 13	3400	7.5		25					
υΑΤΕ	РНО 09 0 50L	05- HUS. 140. IS- VEO G/L P)	H4RI)= VESS (MG/L 4S CACO3)	HAMD- NESS: NONCAP- HOMATE (MG/M, CACO3)	CALCIUM OTS- SOLVED (MG/L AS CA)	MAGHE- SIUM- DIS- SOLVED (MG/L AS MG)	50010 015= 50LVE (4G/ AS N	4. 50 0 f L 24		SOU LUM PEHCENT	POTAS- STUM+ DIS- 50LVF() (MS/K)	CHI.0 RIDE OTS- SOLV (Mg/ AS-0	t Eu L
25.		.00	690	641	180	58	120		2.0	27	14	45	
MAR (1479	.00	1400	1400	240	190	450		5.3	41	42	310	
JUN	-	. •	• • •	•							_	0.0	
12	•					••							
02.	•									~			
DATE	10 90 (4 45	FATE S- LVED G/L S04)	FLUO- HIDE+ OIS- SOLVEO (MG/L 45 F)	S(L1CA+ 0(S- 50(VFD (MG/L AS 5102)	APSENIC NIS+ SOLVED (UG/L AS AS)	AUROM. DIS- SOLVED (US/L AS 6)	14642 150 1304 1007 AS C	UM MI - DI: Eu SO! L (!/		COPPER, DIS- SOLVED (UGZL AS CU)	IHON. SUS- PF 19F0 RECOV- EPAHLE (UGAL AS FE)	TOTA RECO EPAH (JOV AS E	Ն √- և Հ Ն
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- MAR - 25 -	1979	00	3.0	25									
HIL	-	~ 0	3.0	63	~-	3900			U		780	đ	40
12	•					530	•						
02	•	••			~-	13000.	,		50				
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UE • •	•					80		3	Ú	3			

WATER-QUALITY DATA FOR INTERMEDIATE-QUALITY POND, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMP(ATID	LYZ ER- SAM KE (C	A- Ing	SPE- CIFIC CON- DUCT- ANCE (MICHO MHOS)	-	PH (TS)	CARI DIOX DIS SOL' (MG.	IOE S- VEO /L	ALK LINI (MG AS CAC	/L	HICAR- RUNATE (MG/L AS HC73)			NITHO GEN- NO2+10 OIS- SOLVE (MG/L	PH416 3 OH [H] 0 IS- 0 SULVE (40/L	
0EC • 1	978																
22	1335		8	0920	320	0	8.1	;	1.4		90	11	0	0	. 0	7 -	-
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		PHO:	5 -														
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	DIS- SOLVED	019 Salve			NONCAR		LVED	50L		21G SOLV		1100			OIS-		٠,
	(MG/L	(.46)	/L A	S	(MG/L		3/L	(4(-		(MG	/L	PATEO	SOUT		(MG/L	(×0+/t	
DATE	45 PI	AS F	2) CA	Cn3)	CACOA	1 45	CA	45	46)	AS	(AF		PERC	ENT	45 ()	AS CL)
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	01 \$0 (n	FATE (S=)LVE9 (G/L 504)	FLUN- PIDE+ DIS- SOLVED (MG/L AS F)		VED /L	RSFTIC DIST SOLVED UIGZL AS AS)	() 50(2011 15- 2450 37L 8)	50L	S= VEIJ	CHRI 410 915 50L (06) 45	VEN !	02258 15- 15- 50LVF0 (U9/L 45 CU)	Sol	(S- VEI)	LEAD+ - JIS+ SOLVED (US/L AS 23)	
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O		441)	45 VE)			45 SE}		SE)		SE)	(:413)		AC-FT)		H(3)	3007-02	
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MATER-QUALITY DATA FOR OIL-SKIMMER POND, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMPER ATUHE (UEG C	ICOC	Y C1 F CC IG DL IE A^	PE- IFIC IN- ICT- ICE ICRU- IOS)	PH (UNITS)	010 0 501 (40	RAGN KIDE IS- LVED S/L LUZ1	ALM LINI (MG AS	TY H	ICAH- IONATE (MG/L AS HCO3)	CAR FON1 (MG AS C	NO TE 5	ITRU- GEN+ 2+NU3 DIS- ULVED 4G/L S N)	PHOS- PHAIE. ORING. DIS- SOLVEN (MG/L AS PO4)
DEC - 19	78														
SS	1350	-	- 800	20	1500	7.4	•	4.3		55	67		U	.82	
26 MIR.	15+5	24.	0 300	050	2050	7.2	!			30				3.1	• 0 4
12 0CT	1505	1/*	0 500	20	975	9.5	;	. 0		38	46			••	•-
03	1355	17.	0 804	20	1700	3.0	•			1					•
	PHOS-	PHOS-		LL A	(BE) =		*44	iNE-			*U1002		0	0745-	CHLU-
	PHORUS.	OHTHO	• Had!	- 416	55.	CALCIUM	5	104.	SOU I	(UM+	aD=			SIU4.	HIDE.
	OIS- SOLVE!	() IS-	#£\$₹ (*167		CAH-	015-		IS - VED	013 50LV		5749= 5749=			OTS- OLVED	Jis≕ SULVED
	(MG/L	(MG/L	AS		G/L	SOLVEN (MG/L		.v,	(46		PATIO	SOUT		43/L	(1-10/1
DATE	AS P)	45 PI	CACC	3) C4	C031	AS CA	AS	MG)	AS	44)		PEHC	EAL V	S _i K)	AS CLI
DEC . 19			_	_				_	_						
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36	.090	.0	2 8	60	830	230		9	1/	' 0	2.5		30	13	ø/
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52		50	1.8	26		3	1400		<1		0	6	2	0	5
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	IE AS		AS NI)	AS ZN)			5 581		SEI	(46/		-FT)	AS HG		***
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WATER-QUALITY DATA FOR HIGH-QUALITY POND, HAYDEN POWERPLANT, HAYDEN, COLO.

OATE	TIME	TEMP ATII (DEG	A LY PER- 5A IHE (ENCY NA- ZING MPLE CJOE MBER)	SPE- CIF CON- DUC ANCI (MIC- MHO)	IC T- E - <u-< th=""><th>PH INITS)</th><th>AU10 IO</th><th>S- VED I/L</th><th>ALK LINI (Mij AS</th><th>TY</th><th>PICAR- HUNATI (MG/I) AS HC03</th><th>F CA 50N 6M</th><th>9 ATE (3/L C()3)</th><th>NITA GEN NOZ+N DIS SOLV (44/</th><th>03 ED</th><th>PHOS- PHATE. ORTHO. OTS- SOLVEN (HG/L AS PU4)</th></u-<>	PH INITS)	AU10 IO	S- VED I/L	ALK LINI (Mij AS	TY	PICAR- HUNATI (MG/I) AS HC03	F CA 50N 6M	9 ATE (3/L C()3)	NITA GEN NOZ+N DIS SOLV (44/	03 ED	PHOS- PHATE. ORTHO. OTS- SOLVEN (HG/L AS PU4)
DEC . I	1973																
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00		•		,,,,,,,			••				•						
DATE	PHOS- PHORUS. OIS- SOLVEO (MG/L AS P)	Üİ	PUS. IMJ. H IS= N IED ((ARO+ ESS MUZE AS ACO3)	HARI NES' NOUC NOUA (NG)	5+ CA AH+ N FE S /L (LCTUM ITS- IOLVED MG/L IS CA)	51 71 506 649	NE- UM+ S- VED /L MG)	15001 015 50LV (116 45	- E0 /L	50010 50000 7100 71100	- -) 500	TUM CENT	POTA STU OTS SOLV (MG/	ED L	CHLO- HIDE+ DIS- SOLVED (WHZL AS CL)
DEC . I				,	.,		.,	٠,			• • •		•			•	
22	.251)			340	:	340	92	2	7	8	2	1.	.9	34	H	.5	37
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NUL 12				••									••				
0CT	••	,		•-													
ć	, , , , , , , , , , , , , , , , , , ,	LFATE IS- OLVED MG/L SO4)	FLUO- RINE: DIS- SOLVE (MG/L AS F)	0 t 50 0 (*	.TC&+ (S=)LVED (A/L (S) (G2)	AHSENT DIS- SOLVE (HG/L AS AS	n 50	13011. 115- 11450 1671 1681	50: (U	#U1# - 21 LVEU G/L - (G2)	(Ur	.VED	COPPER • OLS= SULVEO (UHZL HAS (CU)	1) S () (1)	ΩN+ IS− LVFU GZL ≅FF)	LF4 01 50L (UG	5- VĒU /L
	C • 1978	420	,				,	990		<1		•			9.0		
MA	AR . 1979		1.		12		1			41		0	8		30		2
	ìN 50	330	1.	5	15	•	•	1490				0			30		
	12 T		-	-		-	-	1500				••			60		
G	3		•	•		•	•	1500		•-		10					**
ι	N S (ANGA+ ESE+ OLS- OLVED HUZL S M4)	NTCKEL 015- 50LVE (UG/L AS NI) 50 (t	(NC+)TS+)I VEO GZL - ZN1	SELE- NTIMA NIS- SOLVE (US/L AS SE	NI S PE	LE- UM. SUS- NIFO (TAL (GZL)	116 TO (U)	LE- 114. TAL 15/L SE)	SOL	OF :	SOLIUS • OIS = SOLVED (TONS PEU AC=FT)	n S n (U	CUPY TS= LYED G/L HG)	SAM SOU	
) a	C . 1479																
á	22 14 • [9/9	130		6	50		\$					710	.97		.0		•0
ě	···	40	-	-	50		•					576	.75				
	12	10	•	•	••		• •										
	:T)3	~~	•	-	10		2	ŧ		£							

DATE JAN + 1 11 MAR 27	TIME 979 1530 1415	TEMPER- ATURE (DEG C)	AGENCY ANA- LYZING SAMPLE (CODE NUMHER) 80020	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH (UNITS) 7.3 7.6	CARHON DIOXIDE DIS- SOLVED (MG/L AS CO2)	ALKA- LINITY ("1G/L AS CACO3)	BICAR- BONATE (MG/L AS HC03)	NITRO- GEN- NUZ+NO3 DIS- SOLVED (MG/L AS N)	PHOS- PHAYE, ORTHO: DIS- SOLVED (MG/L AS PO4)
13	1315	55.0	80020	550	8.9	.2	61	74		***
02	1615	17.0	90020	355	В.9		91			60 66
OATE	PHOS- PHORUS, DIS- SOLVED (MG/L AS P)	PHOS=, PHORUS. ORTHO. DIS= SOLVED (MG/L AS P)	HARD- NESS (MG/L AS CACO3)	MARQ- NESS. NONCAR- UONATE (MG/L CACO3)	CALCIUM DIS- SULVED (MG/L AS CA)	MAGNE- SIUM. DIS- SOLVED (MG/L AS GG)	SOUTUM. DIS- SOLVED (MG/L AS NA)	SODIUM AU- SORP- TIUN RATIO	SONTU" PERCEGT	POTAS- STUM+ DIS- SOLVED (MGZL AS K)
JAN • 1	979 •970	.01	120	0	31	10	20	.8	26	2.3
MAR			150	9	31			_		٤.5
27 JUN	.050	.05	150	53	3A	14	26	.9	21	ۥ4
13	••			**	•-					~~
05 OC1		**		**				••	••	
OATE	CHLO= RIDE+ DIS= SOLVED (MG/L AS CL)	SULFATE DIS- SOLVED (MG/L AS SO4)	FLUN- RIDF+ DIS- SOLVED (MG/L AS F)	STLICA. DTS- SOLVED (MG/L AS STO2)	ARSFNIC DIS- SOLVED (UG/L AS AS)	80204+ 015- 50LVEU (UG/L 45 8)	CADMIUM DIS- SOLVED (UG/L AS CD)	CHRO- MIUH. DIS- SOLVED (UG/L A'S CR)	CUPPER + DIS- SOLVED (US/L AS CH)	IROM• - 015+ - 50t vED (UG/L - 45 FE)
JAN . 1			_		_	_				
11	9.6.	43	•2	13	l,	6 u	<1	0	1	190
27	10	80	.2	11		140		U		4.3 0
13	••		••		**	80			••	160
02	**		•=		••	60		0		401 4 (p)
DATE	LEAD+ OIS+ SOLVED (UG/L AS P3)	MANGA- NESE+ DIS- SOLVED (UG/L AS MN)	NICKEL+ DIS- SOLVED (UG/L AS NI)	ZINC. DIS- SOLVED (UG/L AS ZN)	SELE- NIUM. OIS- SOLVED (UG/L AS SE)	SELE- NIUM+ SUS- PENDED TOTAL (UG/L AS SE)	SELE- NIUM. TOTAL (UG/L AS SE)	SOLIDS+ SUM OF CONSTI- TUENTS+ DIS- SOLVEU (MG/L)	SULIDS+ DIS- SOLVFU (TONS PER AC-FT)	MERCURY DIST SOLVED (UG/L AS HG)
JAN . I										
11 MAR	2	30	4	<3	0			196	.21	• 9
27		40		10	1			245	.33	
13 OCT		20			Ĵ				-	9 9
UC 1				0	0	U	o			

WATER-QUALITY DATA FOR WELL HS-1, HAYDEN PONERPLANT, HAYDEN, COLO.

DATE	TIME	TEMPER- ATURE (DEG C)	AGENO AHA- LYZIN SAMPL (COO	Y CI CU IG DU E A'1	E- FIC N- CT- CE CHO- OS) (1	PH Units)	0 (0) 10 10	S- (VED :	ALKA- LINITY (MG/L AS CACO3	ACTI (Mr	itty ac ive (is	CAR- INATE MIS/L AS ICO31	CAR BONA BN) BN) CAR	TE /L	NETRO- MEN- MEN- SOLVEN MEN- MEN- MEN- MEN- MEN- MEN- MEN- ME
0EC • 197	79									•					
22 194 , 194	1147	8. 0	808	20	1900	7.6		6.8	13	9 14	• 0	170		0	1.6
26	1110	10.0	890	20	74 u	7.7			16	Ú	••			•	3.7
JUN 12 OCT	1040	13.0	800	20	790	7.6		A.4	17	v	••	210			
42	1145	17-0	មពថ	2 0	550	7,48		~~	1.5.	0		**			
	PHOS- PHAIE. ORIHI. OIS- SOLVED	PHOS- PHOKUS. DIS- SOLVED	PHOAU PHOAU ORTH OTS SOLVE	5. 10. 44 - WF	90- : 55 M	4470- 4655+ 74634- 7447E	CALC		MAGNE SIUM UIS- SOLVE	* SUD1	1UM • 5	0010M 40≠ 08P= 1104			POTAS- SIUM- OTS- SOLVED
DATE A	(45/L (5 PO4)	(MG/L 45 H)	(HG/	L A	5	(497L (497L	(.46		(46/L	(:40		4110	SOUTH		AS KI
0EC • 197	-	•••	4., •	, ,		unc./J/		447		, 13	****		7 2 3 4		
22 4ar - 14/ 26	.09			 03	850 230	710	14	;a	90 24	19	10 10	2.2		28	5.4 3.7
12	••	•••	•						-			**			
02													*		
	74 10	5- 0	LFATE 15~ OLVEO	FLUA+ 910F+ 015- 50LVF0	SILIĆ NIS- SOLVI	445 En 1)	enic IS+ Even	병이네 이 [1 SOL:	5-	A7#{UM -0[\$= \$0[,VE()	CMHU- MIU/1, 015- SOLVE	COP	inga, 'S=	nt 1 a a	5-
DAI	[∨] ('4	5/L T	MG7L 5041	(40/L 45 F)	8105	TH)	R/L AS)	AS :	/L	AS CU)	(ÚĞYL AS CR	, (H	(CU)	AS	1
	. 1978														
.SS RAM	1479	50	900	.7	13		1	1	100	0		U	٠		U
אניר אניר	•••	29	160	.4	12		. ••	10	300			Ü			10
12.	•••			-			**	1	180	**	•	•			20
02.	•••	**	**	**		••	**	1	3 60	**	1	0	. ••		-
	ი 50	AD• v I S- LVED S	ANGA- ESE+ OIS- OLVED UGZL	NTCKEL• DIS= SOLVED (UGZ),	2140 - 2140 - 2140	NI - D En SO	LE- UH • 15- LYFD G/L	SELI NEU SUS PERI TOTA	4. 3- ' XEU '	SELE- NTHM+ FOTAL HJG/L	SOLIDS SUM OF COMSTI TUENTS DISH SOLVE	50L - 0 - \$n	105. 15- LVFD nV5	पहुंच्छ २१ ५०८ १७४	S= VEO
DAT		P4) 4	S MM)	AS NII		-	SF)	AS		AS SE)	(MG/L		- F1)	AS	-
55.	, 11/A , 1979	5	600 600	. 18	:	20 ,	a				. 1 + 9	· · ·	2.03		•0
26. Jilly		••	40		;	20	. 4		••		. 44	4	. 43		
12. 0¢f	•••		44		•		19			••	•		••		
95.	• • •		**			0	2		U	2.	•				

WATER-QUALITY DATA FOR WELL HS-2, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	ΔTI	PER- IKE G C)	PAGENIA LISY J LISY J LOS LOS LOS LOS LOS LOS LOS LOS LOS LOS	CY C1 - CC NG DI I.E. 4^ DE (MI	PE- (F [C)N- (C C (C+0)- (O+5)	-	^у н (TS)	D [0 / D [0 / S ()40	RAUN KIDE LVED G/L GO2)	LIN (M) A)	G/L	BICA BONS (AA	ITE I/L IS	CAR BONA (M) AS C	TE	NOZ+	No NO3 S- VED /L	PHUS- PH4[F. PR[H0. PIS- POLYED (N.3/L S. PO.)
DEC . 1978						1450				8.6		140		170		u	,	.4	
22 1979	1155		7,5	40	020	-		7.5		a • D		_		_		-	_		
26 I	1300		10.0	80	020	750		7.8				160					3	.1	.00
12	1050		13.0	40	020	690		7.6		8.4		170		210					
02 !	130		13.0	AU	020	540		7.8				150							
DATE	PH0 01 50	IOS- IAUS・ IS- ILVED IG/L iS P)	OR O SOL	HUS. THU. TS-	45 45/6 46/6 46/6 46/6 46/6 46/6 46/6 46	448 465 4040 4044 (43 CAC	S. AR- TE VL	0°1 50 (14	CI:)4 5- GVL GVL C4)	9 9(1)	AGNE- STUM+ STS- DLVED AGZL SMG)	91 90L (4		Si) T	01UM 40- 44- 104 110	50n PE40	[IJ ^u CE~-T	90149 910 0154 90146 (4678 AS 41	4 • • ElJ •
DEC .			-5	•	00		,				-								
 	•	.050			870)	730	2	00		89	1	50		5.2		27	6	.1
26	-	.030		.00	210)	50		43		25		87		2.6		47	3.	. غ
NI:F						•													
001					-	•													
DATE	81 01 50	ILO- IDE+ IS- ILVED IG/L IG/L	01' 50(FATE S- LVED G/L S041	FLU0- 2[05- 0[5- 50[VF) (MG/L AS F)		ven /L	n 5i) (U	ENIC IS- LVED G/L AS)	S(040N+ 015= 0LVED 06/L 6 8)	50 (U	MIUM IS- LVED G/L CU)	41 01 50 U)	40- 154. 5- LVFU G/L CR)	(1)(_	190% OES SOLVI (UGZ) AS FI	- Ευ -
0EC •		L 0		1 0	•	, ,	3				1100		1		10			,	žo
22 Mar +	1979	.50		10					1		1100				-		•		
26 JiJN	•	31	1	90	1,0	1	2				1100				v			;	LO
12	•					•					930								lu
42	•			••	••	•					900				0.			•	••
DATE	() 5 () ()	[A() + 115- 0LVEO 167L (-P4)	4F 1) 50((U	444- 5E+ 15- LVED 67L 441	MICKEL OF SOLVES (1117)L	91 305 (US	S- VFO	N (1) 50) (U	LE- 1944 [S- LVED 67L SE)	시 일 무현 ((ELE- 1444 • 505- 144E 144E 1457E 5 SE1	4 (Tt) (U	LET IM. TAL G/L SE)	SUM CON TUE D SU	105. OF 511- 	SAL (T) PE		MERCU- 015- 50LVI (UG/L 45-4-	i i
0EC •		2		1300	18	?	Su		0						1510	ı	215		, t _r
+ HAP	19/7			140	••		10		3						503		.69		••
JUN 12				109					12									•	••
7CT 82				••	••	•	10		.3		0		3					•	

DATE DEC + 1	1125	TEMPER- ATURE (DEG C)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER)	SPE- CIFIC CON- DUCT- ANCF (MICPO- MHOS)	P4 (UNITS) 7.4	CARBON PACE OIOXIDE OISVED (NG/L AS CO2)	ALKA- LINITY (MG/L AS CACO3)	BICAR- BONAFE (MG/L AS HCO3)	NITRO+ GEN. NOZ+NO3 DIS- SOLVED (MG/L AS N)	PHOS- PHATE: OPTHO: UIS- SOLVED (MG/L AS PO4)
MAR • 1	979 1315	11.0	90020	1800	7.5		160	••	1.5	.06
JUN 12	1110	12.0	80020	2020	я.5	9.6	160	190		
02	1150	13.0	80020	2180	7.7	•	160	••		••
.,	1130	13.0	90020	2100			100		-	
DATE	PHORUS: PHORUS: PDIS- SOLVED (MG/L AS P)	PHOS- PHORUS, ORIHU. DIS- SOLVED (MG/L AS P)	HARD= NESS (467L AS CACO3)	HARD- HESS+ MONCAR- HONATE (MG/L CACO3)	CALCIUM DIS- SOLVED (MS/L AS CA)	MAGHE- STUM+ DIS- SOLVED (MG/L AS (46)	SODIUM+ DIS- SOLVED (MS/L AS NA)	500 IUM AD= 50HP= 110N RAT10	SONIU4 PERCENT	POTAS= 510M* 0TS= SOLVED (MGZL AS K)
UEC • 1										
22 MAR • 1		•-	1100	970	270	110	550	2.9	39	5.9
25 JUN	.060	•00	820	650	180	89	170	5.6	31	6.4
12	**	•		•-		••				**
02										
DATE	CHLO- RIDE+ DTS- SOLVED (MG/L AS CL)	SULFATE OTS- SOLVED (MG/L AS SO4)	FLDO- RIDE. DIS- SOLVED (CIGAL AS F)	SILICA. OIS- SOLVED (MG/L AS SIO2)	ARSENIC DIS- SOLVED (UG/L AS AS)	BORON: UTS- SOLVED (UG/L AS 8)	CADMIUM DIST SOLVED (JG/L AS CD)	CHRO- MIUM. DIS- SOLVED (UGV[AS CR)	COPPES DIS- SOLVED (UG/L AS CU)	IRON+ OTS- SOLVEU (UGZL AS FE)
DEC • 1		1200	,	14	,	1400	•	_	æ	3.0
22		1200	• 1	14	1	1400	1	-	5	10
70N 26	140	780	.8	12		1100				120
12				••		940		**		50
05						1300		U		
ŊΑ	SUL (UG TE AS	0+ NES 5- 01 VEO SOL VL (UG	S= 015 VED 50L VL (UG	VED SOL	S- 01 VED SOL /1. (1)6	M, SU S- PEN VED TOT VL (UG	IM, IS= SEL IDEO VIDI AL TOT	M+ TUEN AL OT ZL SOL	OF SOLI TI- OT	S+ VEG MS K
25.	• 197H	?	200	11	40		••	 2	110 2	.87
	. 1979		40	••	20	2		1		.01
12.	• • •	••	40			1	~~			
120	• • •				1,0	1	1	2		

WATER-QUALITY DATA FOR WELL HS-4, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE DEC , 197 22 448 , 197 26 JUN 12 OCT	1140	AT 363	PE4- UHE G C) 8.5	Au-	CY C1 - C0 NG DU NE A"	2540 2500 2500 2500	PH ((TS) 7.5 7.6 7.5	010 010 102 (40	RRON AIUE IS- LVED G/L CO2) 9.6	LIN (M)	KA- ITY 6/L S C03) 160		ITE F/L IS	CAH HONA (MG AS C	TE 7L	GE Nn2+) I SOL (*46 45	N. P NO3 () S- VED S /L (HOS- HATE: HATE: UIS- UIS- UIS- UIS- UIS- UIS- UIS- UIS-
02	1200		12.0	30	020	2000	7.6				160						~~	
ŋ a ĭ	Pi i	PHOS- HORIJS, DIS- SOLVEU (MG/L AS P)	P-101 0-21 0 50L1 (Mi	05- PUS, THO. IS- VED S/L P)	HAPP- 1655 (MI)/L 45 C4C03)	HARD- NESS- NONCA HONATE (MG/L CACO3)	01 50 (4	CIUM S= LVED G/L CA)	ડ ઇ 50! (બા	GHE- IUM, IS- LVED G/L MG)		; -	5/)H	JN	500 TO		POTAS: STUR OTS- SOLVE: (MG/L AS K)	. 1 <i>i</i>
22.		.060			1100	970	5	713	1	10	23	0		3.0		31	7.	6
20.		•040		.01	839	670	٤	1)		75	20	0		3.0		34	6.	>
JUN 12.	• •	••				• ••										••	-	•
0CT	• •																-	-
TAG	E .	CHLO- RIDE: DIS- SOLVED (MG/L AS CL)	01: 50! (%)	FATE 5+ LVEO 5/L 5041	FELIO- REDE: DIS- SOLVEO (4671 43 F)	51L1CA+ 015+ 50LVED (467L 45 5102)	4RS (U	ENTC IS- LVFU G/L AS)	ีย รงเ (ป	RON. IS- LVEU G/L H)	SOL (U/-	IUM S- VED VL CU)	(06	VED	COP06 015- 50L) (116,	/F-) /L	EMON* OLS* SULVEI (UGVL AS FE.	
55. 0 6 C	• 197	3 200	110	9 0	.7	14		ı		1400		2		ų.		4	6	u
MAR 26.	. 197		-	0.0	.8					1200				Ü			5.	-
JÜN 12.			,		• "					750				_				
OCT																	1,	J
02.	••					• ••		. 		1500				10				-
ŲAT	•	_EAD+ _0[5+ 50[¥60 (UGZ[AS_P4)	41E 4 501 (110	NGA= 5F • 15= _ vEi) 5/L _ vI)	NICKEL. OIS- SPLVEO (UGVL AS NI)	DIS+ SOLVED (HGZL	11M 3 (U)	LE+ (JM+ IS+ LVE() (37) (37)	NEC SE PEC TO	LE- 14. 15- 10EU TAL 3/L SE1	SEL 411) 101 (40 45	1:4 • 'AL		0F TT- TS• VFU	50L10 015 50LV 110N PER	} - /4·) !5	MERCURY DIS- SOLVE (UG/L AS MG))
22.	• 1970 • 1971	2		ゅうい	15	40		o					4	v 3 0	۶.	,76	• (,
20.		·		510		Su						2	1	65u	ë.	4۾,		•
15. 15.	••			150				1									•	•
05.	••					10		1		1		2						•

		TEMPER-	AGENCY ANA- LYZING SAMPLE	SPE- CIFIC CON- OUCT- ANCE	РН	CARBON DIOXIDE DIS- SOLVED	ALKA- LINITY (MG/L	BICAR- BOMATE (4G/L	NITRO- GEN+ NO2+NO3 DIS- SOLVED	PHOS- PHATE: OFTHU: OIS- SOLVED
DATE	TIME	ATURE (DEG C)	(CODE NUMBER)	MH02)	(UNITS)	(MG/L AS CO2)	CACO3)	HCUJ)	(MG/L AS N)	(MG/L AS PO4)
0EC + 1	1030	9.0	80020	612			170	210	•85	••
MAR • 1	1400	9.0	90020	560	7.5		150		1.1	•25
12 OCT	1310	13.0	80029	650	7.4	15	200	240		
02	1400	12.0	80020	760	7.6		240			
GATE	PHOS- PHORUS. DIS- SOLVED (MG/L AS P)	PHOS- PHORUS. ORTHO. DIS- SOLVED (MG/L AS P)	HARD- MESS (MG/L AS CACO3)	HARD- NESS: NUMCAR- BONATE (MG/L CACO3)	CALCIUM DIS- SOLVED (MG/L AS CA)	MAGNE- SIUM, DIS- SOLVEU (MG/L AS MG)	SODIUM+ DIS+ SOLVED (MG/L AS NA)	500 IUM 40- 50RP- 110N RAFIO	SODIUM PERCENT	POTAS- SIUM+ ATS- SOLVED (MGZL AS K)
S2	9/9 .060		240	70	64	20	38	1.1	25	3.8
MAR , 1 26	979 •100	.08	520	74	60	18	35	1.0	25	5.2
12					••					
02				••						
DATE	CHLO+ RIDE+ DIS+ SOLVED (MG/L AS CL)	SULFATE DIS= SOLVED (MG/L AS SO4)	FLUO- RIDE- DIS- SOLVED (MG/L AS F)	SILICA+ DIS+ SOLVED (MG/L AS SIO2)	ARSENIC DIS- SOLVED (UG/L AS AS)	BORON+ DIS- SOLVED (UG/L AS 8)	CAUMTUM 	CHRO- MIU4. DIS- SOLVED (UG/L AS CR)	COPPED. DIS- SOLVED (UGZ) AS CH)	IROV. - 015- - 50L/E0 (UG/L AS FE)
DEC • 1	976 28	110	.8	14	1	490	1	10	ı	lu
MAR , 1 26		100	.7	13		1900		0	••	60
-12	***			••	••	1500				10
02	₩ ₩					2000		10		
	LEAD. 015- 50LVED (UG/L	MANGA- NESE+ DIS- SOLVED (UG/L	NICKEL+ DIS- SOLVED (UG/L	71 NC • 0 15 - SOL VEO (UG/L	SELE- NIPH+ OTS- SOLVED (UG/L	SELE- NIUM. SUS- PENDED TOTAL (UG/L	SELE- NIUM. TOTAL (UG/L	SOLIDS+ SUM OF CO 45fI= FUENTS+ OIS= SOLVED	SULIDS. DIS- SOLVED (TONS PER	MERCURY DIS- SOLVED (UGVL
DATE	45 P4)	V2 451)	AS NI)	45 7N)	AS SE)	AS SE)	AS SE)	(MG/L)	AC-FT)	AS 73)
22	2	190	4	20	2			387	.53	• ()
44R • 1 26••• Jijn		140	• =	20	2			357	.49	
12		3 0			2					
02				10	3	ŋ	3			

WATER-QUALITY DATA FOR WELL HS-6, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMP ATU (DEG	HE (CO	1- CO NG DU LE 4-:	FIC N- CE C-U-	D.	CAHRON IOXIVE DIS- SOLVED (MG/L S CO2)	[14] (이) 보	5/L (M) 5	TE CAS	GE NO24 01 01 01 01 01 01 01 01 01 01 01 01 01	No PH NO3 OR (S= 0) VED SU S/L (*)	05- ATE IS- IS- IS-
DEC . 197			7.0.00		*0.7				100	330	0	un	_
22 MAR + 197				020	782	7.3	18		180	520		.90	-
95 NUL	1415	ı	0.0 AC	020	580	7.7			180)	. • 4	• 1
12 0CT	1330	1	3.0 an	020	545	7.6	9.4		170	210			-
02	1415	ı	3.0 50	050	3 80	7.6			240				-
?2.	PHO DI SO (4 E AS 1979	05- 905- 905- 5- 5- 607- -010 -010 -010	PHOS-PHORUS. OPTHU: UIS- SOLVED (MG/L AS P) .04	HADD- NESS (MS/L AS CACO3) 280 280 FLUO- RIDF.	HARD-NESS. HONCARE HONATE (MS/L CACO3) H3 100	74	19 SG	AGNE- 619M. 015- 01VED 04G/L 6 4G) 24 23	SODIUM. DIS- SOLVEU (MG/L AS MA) 42 41	SODIU4 A0= SOHP= TIU4 RATIO 1.1 1.1	\$001U	POTAS- SIUM+ DIS- SULVEO (MG/L AS K)	
	0 t 50	5- LVEJ	DIS- SOLVED	UIS- SOLVED	SALVEA (MG/L	015- 50L75	r 50	IS- ULVEU	OIS= SOLVED	DIS- SULVEU	U15- SOLVED	OTS- SOLVED	
DAT	-	G/L CL)	(MG/L AS SO4)	(MG/L AS F)	(S012	(11G/L		33) 33)	AS CD)	(IIG/L AS CR)	AS CU)	(US/L AS FE)	
22. Mar 26.	19/9	35 3 5	150	.8 .7			1	51 v 23 u v	1	υ 0	2	. 70	
12.	••						••	230				19	
0CT	••					-		1900		0			
QATI	n 50 (1)	40+ [S= LVE) 67L PH)	MANGA- NESF + DTS- SOLVED (UG/L AS IN)	NICKFL+ 015- 50LVF0 (0671 45 NI)	7140+ 015- 50LVED (UG/L 45 74)	\$86.5- \$10%- 015- 506.48 (UG/6 A5 S8	NI PE In Tu	(LE= (UM+ (US= (NOED))TAL (SE)	SELET NIOM: TOTAL (JAZE AS Sc.)	SOLIDS. SUBJOE COMSTT- FUENTS. UIS- SOLVED (MOVE)	SULIDS+ `IS= SQLVED (TONS PER AC=FT)	√€⊅€∂∂₹ ○TS≠ S∩E√€∂ (JG∧E AS +65)	
	. 1975	•	,	· • •		J.	., -12	•••••	43 367	, 0,,,	-C-F1)	M3 577	
	. 1379	4	35:1	ے	20		5			420	.57	• 0	
7:14 50+			210		10		4			429	.54		
12. QCT			50		••	-	•-						
15.	• •				1 11		4	U	4				

WATER-QUALITY DATA FOR WELL HS-7, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMP ATU (DEG	KE (CU	16 010 EE ANG	FIC 0T- 0E (190-	Dī PH S (ARBON OXIDE OLIST OLVEN MG/L CO2)	ALK LINI (MG: 4S CAC	TY BONG	ATE CAR VL BONA NS (MC	GE NO24 P= 01 LTE SOL SVL (-40	5- 015- VED SOLVI	E
DEC . 197													
22 197	1315		80	020	1350	7.6	9.6	,	200	240			-
dS	1515	1	0.0 80	050	1110	7.5		i	220	••	1	7) (
12 TOC	1340	1	3.0 80	020	1100	7.4	13		170	210	••	••	-
02	1445	1	4.5 80	020	1060	7.3		1	290			••	
DAT	PH D S (HOS- ORUS. IS- OLVEN HG/L S P)	PHOS- PHORUS. ORTHO. DIS- SOLVED (MG/L 4S P)	H4RD= HESS (MG/L AS CACO3)	HARD- NESS+ NONCAR- SUMATE (MONL CACOS)	CALCIU DIS- SULVE (MG/L AS CA	M 51 01 50L (MG	NE- UM+ S- VED I/L MG)	SODIUM. DIS- SOLVED (MG/L 4S NA)	SUD TUM AU- SUMP- TION RATTO	SONTU-PERCENT	POTAS- STU4+ DIS- SOLVED (467/L AS K)	
22.	, 1978	.000		514	410	150	5	66	91	1.5	25	4.3	
26. JUN		.030	.00	390	170	100	3	15	97	2.1	35	••3	
12.	• •					-	-					~ •	
021 02.	• •					-	-						
22. MAR 26. JUN 12. OCT	R 9 5 (# # 1978 • 1979	HLO- IDE+ IS- IS- OLVEU HG/L 9 CE) AO	SULFATE DIS- SOLVED (MG/L AS SOA) 450 280	FLU0- PIOF. 015- SOLVEO (15/L AS F)	SILTCA. DIS- SOLVED (MG/L 45 STO2)	SOLVE (UG/L AS AS	01 0 SOL (Ud) 1 AS	9) 40u 100u 23u	CADMIUM DIS- SOLVED (UG/L 45 CD)	CHRO- 41UM. 015- 50LVED (UGVL 45 CR)	CUPPERSON DISSINGUE SOLVED GOOD AS CU)	120% 0152 50L/450 (U5/L AS FE) 10 0	
02.	L! S	EAD. 115+ OLVED	MAMGA- NESE+ OIS- SOLVED (UG/L	**************************************	ZINC・ ひIS- SINC・	SELE- NIOM- OIS- SULVE (UG/L	SEL NIU SU PEN O TOT	M+ IS- IDED IAL	SELE- NEUM. FOTAL (UG/L	SOLIDS* SUM OF CUNSIT- FUE 415* 015+ SOLVED	SOLIDS. DIS- SOLVED (FONS PER	*FRCJ#Y J (S- SOLVED LUGZL	
	. 1978	5 2-1)	AS "'1)	45 41)	45 /11)	AS SF.) AS	SEi	AS SE)	(146/L)	AC-FT)	45 417)	
	19/4	5	210 20	5	30		4			974	1.32	• 11	
56 101 12			70 20		20	•				734	.99		
92.			Z()		10		3						
9€ •	• •				11)		5	Ü	5				

	*****	TEMPER-	AGENCY ANA- LYZING SAMPLE	SPE- CIFIC CON- DUCT- ANCE	ρн	CARBON DIOXIDE DIS- SOLVED	ALKA- LINITY (MG/L	ACIDITY (MG/L 45	HICAR- HOMATE (MG/L AS	NITRO- GEN+ NOZ+NO3 DIS- SOLVED (MGZL
DATE	TIME	ATUPE (DEG C)	ANWAFE) (COUE	(MECRO=	(UN[TS)	(MG/L AS CO2)	AS CACO31	CACO3)	HC03)	45 1)
UEC • 1	97A									
21 MAR , 1	0930	9.0	80020	1620	7.3	15	160		199	2.2
27	0839	9.0	80020	1800	7.1		150	150		1.4
JUN 12 OCT	1340	13.0	90020	950	7.1	80	130	~~	160	
03	9900	11.9	80020	900	7.4		200			
	PHOS- PHATE.	PHOS-	PH05-		HARD-		MAGNE-		500I+14	
	ORTHO,	PH0RU5•	ORTHO,	HARD-	MESS+	CALCIUM	SIU-1.	SOU LUM.	40-	
	015÷ SOLVED	DIS- SOLVED	01S − S0LVFD	MESS (MG/L	NONCAR+ ROMATE	DIS- SOLVED	OIS- SOLVED	DIS÷ SOL≠ED	504P- T10√	
	(MG/L	(MG/L	(MG/L	45	(467L	(MG/L	(MG/L	(べら/L	RATIO	\$001U4
DATE	15 0041	45 2)	45 P)	CACO3)	CACO3)	AS CA)	45 4G)	45 HA)		HE 4CEMI
S1	973	.080		700	540	150	78	75	1.2	19
MAR + 1	1/9	•								
27 JUN	.01	.060	.06	830	580	230	63	100	1.5	51
12 OCT			-			••				
03			-		**			• •		
	POTAS-	CHLO-		FLUO-	SILIC1.			CHRO=		
	SIUM.	RIDE.	SULFATE	RIDE,	9 15 -	ARSENIC	9080N•	M[UM.	CUSEEA.	150.4+
	DIS- SOLVED	DIS- SOLVED	DIS≕ SULVED	DIS÷ SOLVED	SOLVED (MG/L	DIS- SOLVED	DIS- SOLVED	DIS- SULVED	UTS÷ Salved	OIS- SOLVEU
	(MG/L	(MG/L	(MG/L	(MS/L	۸S	(UG/L	(UG/L	(UGZĘ	(HGZ)	(1)6/6
DATE	45 K)	45 CL)	AS 504)	AS F)	\$102)	AS 45)	AS H)	AS CR)	AS CUI)	AS FE)
DEC • 1		120	820	•	17	1	490	10	2	1.0
21 MAR • 1	979	•			17	1		_	د	10
27 JUN	5.2	110	690	• 4	16		2400	U		10
12			*-	₩.		••	1600			
03		***					1900	10	••	•
						SELE-		SOLIUS:		
		MANGA-			SELE-	NIUM.		SUM OF	501105+	
	LEAD+	NESE.	NICKEL+	2110.	NIJM.	SUS-	SELE-	CONSTI-	nts-	
	nţ5≠ SaLVED	nts÷ SolvED	ATS≁ SOUVEO	DIS- SOLVED	SOLVED OIS-	PENDED TOTAL	NTUM. TOTAL	THENTS.	SOLVED (TONS	MANGA- NESE
.	COGNE	(UG/L	(UGZL	(HG/L	(1)6/L	(いら/レ	(UG/L	SOLVED	ÞĒB	(UG/L
DATE	45 PH)	AS MN)	AS NI)	45 ZN)	AS SE)	AS SE)	AS SE)	(46/6)	AC-FT)	AS 4N)
DEC • 1	978 2	740	3	20	5			1370	1.45	
MAR + 1	4/9									
27 NUL		79	~-	20	4			1310	1.78	70
12		60		7-	2					
٠				a	3	Ü	3			

WATER-QUALITY DATA FOR WELL HS-9, HAYDEN POWERPLANT, HAYDEN, COLO.

OATE		ΔT	PEH- UHF G C)	AGENI ANA- LYZI: SA -I-II (CI) ¹ NUMBE	CY CI - CO NG DU LE A (DE (MI EH) MH	(41)- (05) (UN	PH [TS)	010X 01 50L (46 AS C	5- VED VED	(MI)	∆/L S C03)		4TE 7/L 45 13)	CAP HONA (MG AS C	TE /L (03)	GE NO2+ OI SUL (MG AS	N+ P 1403 0 S- VED S VL (N) AS	HUS- HATE. HIHO. DIS- OLVED AG/L PO4)
21 4AR , 19	- 1110 79		5.0	HO	020	1070	7.6	1	1		230		580		0	2	•1	
27 JUN	0400		10.0	90	020	1150	7.8				240					3	.6	.03
12	1350		13.0	80	020	1410	7.6	1	2		250		300					
0CT 03	0945		11.0	800	020	1400	7.6				300							
•••	•						. •											
Ŋ A	P 1	PHOS+ HOHUS+ DIS+ SOLVEO (MG/L AS P)	(40 20F) 25 240	75- 205, [-0. ts- veu G/L P)	MARD- MESS (MG/L AS CACO3)	H490- MF59. MOMC49- MOMATF (MG/L C4C03)	n t 50 (M	CT-JM S= LVFD GZL C4)	51 01 50L (80	NE- UM, S- VEU VL MG)	019 SAL. (40		ه ج(۶۰	ON	SOD I		POTAS SIUM DIS- SOLVE (MG/L AS K)	• .s
DEC	. 147		_						_			-			_	_		
21.	• • •	.040			4#0	250		95	•	0		7 7		1.5		56	3.	9
27.		•030		.01	550	310	1	10		7	;	78		1.4		53	4.	ל
JUN 12.																	-	_
0CT 03.																	_	
45.	•••	-								•-							_	_
ΟA	! !	CHLO- RIDE+ DIS- SOLVED (MG/L AS CL)	015 501 (M)	FATE S= LvE() G/L S()+)	FLUCH RIDE+ DISH SOLVED (MG/L AS F)	SILICA. NISH SOLVEN (MG/L AS SIO2)	495 02 (1)	EVIC IS+ LVED G/L AS)	Ð (Sat (a)	4[U4] (S= VEN 3/L (U)	(tit	₩. - VED	015 015 50L ())6 A5	_ VFO /I_	IRCH• DIS= SOLVE (UGZL AS FE	()
	. 197				_													
21. M49	• 197	44	3	50	.9	17		1	1	600		1		10		3	2	v
27. JUN	• • •	59	39	50	.9	16			1	700				10			۶	U
12.0	•••								1	900							1	υ
03.									i	400				10			-	-
04		LEAD. - 015- 50LVEU (1057L 45-P3)	NE! 0 50((0)	NGA- SE+ IS- LVEP G/L	NICKEL+ O(S- SOLVEO (US/L AS NI)	NES- SALVEN (HBZL	17 50 ()	LE- (194 IS- LVF() (6/L SE)	PE* TOT (Oc	14, 15- 10EU 14L	SEL NT TOT Luky	14 . [4 L	SOL	OF TI-	SOLTO DI SOL (TO) PF	5- VED NS	MERCUH DIS- SOLVE (UG/L AS HG	ı,
	• 197				•			- • •				J.,	,	'		• • •	## ~()	•
21	• • •	2		70	2	30		4						n01	1	.19	•	o
MA4 27.	• 197 [.]	· 		110		20		6						H48	1	.15		-
7:1:4				+0				4							•			
961																	-	-
ال ن	•••					0		4		U		4					-	•

WATER-QUALITY DATA FOR WELL HS-10, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	ATL		NCY CI A- CO ING DU PLE AN UNE (MI	C90-	01((PH 5(ARBON OAIDE DIS- OLVED MG/L CO2)	ALKI LIHI (MG, AS CACI	TY RONA	TE CAR	GF NOZ- R=	[RO+ PHO [No PHA NO3 ORT [S+ UI LVED SOU 3/L (MG	475 [HO L > F E > L
DEC + 197	8 1400		8.0 8t	0020	1020	7.7	8.9	,	230	280	0 1	7	•
MAR , 197 27		1	•		1380	7.8			210	••		.5	. 0
JUN 12	1430				1950	7.7	6.4		169	200	••		_
03	1025				2040				230		••		_
03.44	1063	•		0120	2040	7.8		•	230				_
OAT	PH(0) 5(105- 1205- 15- 1675 1676 1676	PHOS- PHOPUS. ORTHO. OIS- SOLVED (MG/L 45 P)	HAPP- NESS (NG/L AS (4503)	HARD- NESS+ NONCAR- HOMATE (MG/L CACO3)	SULVER	71 50L (MG	UM, S- VED /L	SODIUM. UIS- SOLVED (UGAL AS MA)	SULLIUM AU= SOMM= TION HAIIO	SON LUM PERCE «T	POTAS- STJ4+ DIS- SOLVEO (MG/L AS K)	
	, 1978							_					
	. 1979	•020		450			6		76	1.6	27	3.7	
27. JUN		.040	.03	590	380	92	8	7	110	2.0	Śð	4.3	
12.							•						
03.	• •						•						
DAT	R) 0 5,	HLO- (DE+ (S-)LVED HG/L (S-CL)	SULFATE DIS- SOLVED (MG/L AS SO4)	FLU0- RIDF: UIS- SOLVED (MG/L AS F)	STLICA, DIS- SOLVED (115/L AS SIO2)	ARSEUTO JISH SULVEN (UGAL AS AS)	01: SOL (UG:	S- VED /L	CADMIUM OIS- SOLVED (MG/L AS CO)	CHRO- MIU-1- MIS- SOLVED (US/L AS CR)	CUPPES. 015= 50LVE0 (1167L AS C I)	1404+ -015+ 50LVE; (467L AS FE)	
	, 1978												
21. Mah	, 1979	43	330	1.0	16	1	1	700	1	10	3	10	
.75 NUC	• •	71	510	1.2	14		- 1	400		0		50	
12. 0CT	••				••	-	• '	950		••		10	
03.	• •						- 1	300		10	••		
DAT	50 (1	[A).) IS-) LVFN) JG/L JA	MANGA- MESE. DIS- SHLVEU (UHVL AS MN)	NICKEL+ DIS+ SOLVED (UGZL AS NI)	ZINC+	SELE- NIOM+ UIS- SOLVER (MGZL AS SE)	(OG.	4. S- JEU AL /L	SFLE- NIUM. TOTAL (UG/L AS SE)	SOLIUS+ SUM OF CONSTI- TUENTS+ DIS- SOLVEU (MOZE)	SOL (05 • 0 (5 •	MERCHRY DISH SOLVED USZL AS HG)	
DEC	. 1973											~3 ,37	
	. 1119	2	40	5	Su	5	•			758	1.03	• •	
27. Jun			40		10	7	•			1050	1.39		
001	••		30		••	•	<u>.</u>						
03.	••		•-		10	3	1	Э	3				

WATER-QUALITY DATA FOR WELL HS-11, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	ŤI:	45	TEMPER- ATURE (1)EG C)	(C)	NCY C NG n PLE A DOE (M	PET IFIC ON- CCT- NCE ICTO- MOS)	P	н	CARR DIOXI DIS SOLV (MUZ	IDE 5- I VED /L	ALKA LIMIT (MG/ AS CACO	Y AC	1011Y MG/L 15 15 (E004	BICA BOMA (MG A A HCO	re /L 5	CAH: BONA (46,	re /L	NITRO- GE4+ NO2+NO3 DIS- SULVEO (AG/L AS A)
DEC • 1		10	5.0		020	1050		7.5		9.6	,	97	200		240		0	1.2
21 MAR , 1	979										_		-	,	_			
27 JUN	10.	31)	9.5	5 86	020	1200		7.6			1	.60						1.2
12	14	•5	12.0) a(1050	540		7.7	4	.5	1	10			140			
03	10.	30	9.5	, a	020	900		7.6			i	90						
DATE	PHOS PHA ORT OIS SOL (MG/ AS PA	/E, 10. / 5= /ED /L	2405 040305- 015- 501,450 (4671 45-2)	. 041 01	(U5. (H0. H (S- N (ED (4P)- ESS MG/L 4S ACO3)	4AP NES NONC PONA (MR CAC	3. 1e 1e /L	CALC! 1715- 50LV (Mis/	ED L	MAGA SIII DIS SULV (MG/ AS A	64 SG (E) SQ (L) (01UM. IS- LYED MG/L S NA)	SON AI SON TI PAT	0= 2= 1)·4 10	50010 PERCE		9)[45- 5[U4+ (45/4) 45' K)
DEC . I	973																	
21 448 • 1	979		.090	•		+30		240	98	3	46		76		1.6		27	4.9
27		.18	.040)	.06	510		350	120	3	51		97		1.7		27	7.0
J:JM 12				,														
0CT 43				•														
06 2 18 2 3 3 3 10 0 0	2	4	E+ St T S VFJ S VL (CL) 45	##FAFE IS- IS-	•	91 50 0 (** 51	104. 5- LVED 6/L 502) 14	50L (1)6	S= VED	13	5- /E <i>U</i> /L	CARMIU GIS- SOLVE LUGVL AS CO	4 MI 0I 0 S0 (U) AS	RO- ctd. 5- LVEG GVL CR)	COPP JTS SOL TUS AS	T VED ZI,	IRO OI SOL LUN AS	ちゃ いだい プレ
c	DATE	LEA DI SOL (IIG 45	N. \ S= VED S /L (IANGA- IESE + DIS- GUVED TIG/L IS MN)	NTCKFL DIS- SOLVE (UG/L AS NT	n n 50 ()	NC+ 15+ LVED GZL ZNI	90E	M. S− VED	SELE MIUN SUS PENI FOTA (UGA AS S	1; 5=)Eu 11. /L	SFLE- NIUM. TOTAL (UGZL AS SE	504 004 105 0 50	105. OF STI- NTS. IS- LVED G/L)	SOLT OI SOL (To PE AC-	S= VFI) NS R	MFRC OT SOL (UG AS	5- "En /L
	EC • 1	47H	4	20		2	30		7			-	_	736	,	• 00		. 0
MA	AR . 1	779				_												
Jt	27 14 12			20 20	-	-	10		5 2.			-		683	1	• > 0		
()(_	_	n		•		1		5					

				6						NITRO-
			AGENCY	SPF- CIFIC		CARBON				GEV.
			ANA- Lyzing	CON- DUCT-		DIOXIDE DIS-	ALKA- LINITY	RICAR- BONATE	CAR-	E00+4500 -210
		TEMPER-	SAMPLE	ANCE	PH	SOLVEL	(MG/L	(MG/L	BOMATE	SOLVEO
DATE	LIME	ATURE (DEG C)	(CODE MURAER)	(MTCRO- MHOS)	(UNITS)	(SCO 2A	AS CACO3)	AS HC03)	AS CO3)	(AG/L AS 'I)
DEC • 1		2.0					220	370	0	3 /
21 MAR + 1		8.0	90050	770	7.6	11	550	270	0	2.4
27 Ju <u>n</u>	1100	11.0	80020	800	7.5		230			2.1
12	1441)	13.0	80020	780	7.4	18	240	290		
02	1045	11.5	80020	810	7.6		250			
	PH05=		PHOS-							
	PHATE.	PHOS-	240805		HARD-		MAGNE-		Sonlum	
	081H0• 015⇒	PHORUS. DIS-	041H0+	HARD- VESS	NESS+ NONC14-	CALCIUM DIS-	SIUM. DIS-	\$001UM+ -210	40- 508P-	
	SOLVED	SOLVED	SOLVED	(MG/L	BONATE	SOLVED	SOLVED	SOLVED	TIO	
DATE	(4G/L AS PO4)	(MG/L as P)	(MG/L AS P)	AS CACO3)	(MG/L CACO3)	(MG/L As ca)	(MG/L AS MG)	(:445/L AS (NA)	RATTO	SODIUM PERCENT
1/416	M3 F047	45 67	M.3 -1	CACASI	CACOST	43 (47	N3 140)	43 (44)		FERGE 11
0EC • 1		.190	~~	310	90	72	32	59	1.5	24
MAR + 1 27	.43	.230	.14	3 30	96	76	33	58	1.4	27
12										~~
02										
	POTAS=	CHLO-		FLUO-	SILICA.				CHRU-	
	SIUM. Dis-	RIDE.	SULFATE DIS-	RIDE.	DIS- SOLVED	ARSENIC DIS-	3080N+ 015=	CADMIUM DIS=	MTUM. UTS=	OPPER.
	SOLVED	SOLVED	SOLVED	SOLVED	(MG/L	SOLVED	SOLVED	SOLVED	SOLVED	SOLVED
DATE	(MG/L AS K)	(MG/L AS CL)	(MG/L AS 504)	(MG/L AS F)	AS 5102)	(UG/L AS AS)	(UG/L A5 B)	(UG/L AS CD)	(UG/L AS CP)	(UGZL AS CU)
		~3 CC/	-3 (10-4)	A1 ()	31027	-3 N37	47 177	M3 (1))	A3 (*/	4.5 (0)
S1	979 5.2	25	170	.7	16	1	1800	0	10	2
MAR + 1	979					7		_		•
15 NUC	7.6	26	160	•7	15 °		1900		10	
12		**					1600			, ====
Su	-	••					1800		10	
								EOL TOE.		
			-ADMAN			SELE-		SOLIDS: SUM OF	SULTOS.	
	IRON. DIS-	LEAÛ+ Dis-	MESE. DIS-	NICKFL. DIS-	ZINC. DIS-	NIUM. DIS-	SELE-	CONSTI-	∩ (S= S0LVF0	MERCURY DIS=
	SOLVED	SOLVED	SOLVED	SOLVED	SOLVED	SOLVED	TOTAL	UIS-	(TONS	SOLVEO
DATE	(UG/L AS FE)	(UG/L AS PB)	(UG/L AS MN)	(UGZL 45 NI)	(UGZL AS ZAI)	(UG/L AS SE)	(UG/L 45 SE)	SOLVEU (MG/L)	PER AC-FT)	(UG/L AS aG)
DEC • 1	9 78									
21 MAR • 1	0	5	ĄŪ	s	30	10		526	.72	• U
27 JUN	50		70		20	11		525	•72	
12	20		59			11				**
02					, n		8			<u> </u>

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DATE	TIME	TEMPER- ATURE (DEG C)	AGENCY ANA- LYZING SAMPLE (CODF NUMMER)	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	P4 (UNITS)	CARBON DIOXIDE DIS- SOLVED (MG/L AS CO2)	ALKA- LINITY (MG/L AS CACO3)	31C42- 30AACE 467L 45 4C03)	MITRO- GEN+ NUZ+NG3 DIS- SOLVED (MG/L AS N)	PHOS- PHATE, ORTHO: OTS- SOLVED (MG/L AS 204)
DEC . 19	978									
21 MAR + 19	1501 179	6.0	90050	720	7.6	12	240	290	5.5	
27	1045	10.0	80020	1190	7.5		150		1.5	-18
12	1450	13.0	90050	700	1.5	14	220	270		
0CT 03	1100	11.0	80020	974	7.6		270			
DATE	PHOS- PHORUS, DIS- SOLVED (MG/L AS P)	PHOS- PHORUS. ORTHO: OIS- SOLVEO (MG/L AS P)	HAPR- VESS (HG/L AS C4C03)	HARD- NESS+ NONCAR- SONATE (MG/L CACO3)	CALCIUM DIS- SOLVED (MG/L AS CA)	MAGNE- SIUM. DIS- SOLVED (HG/L AS MG)	SOUTUM+ DIS- SOLVED (MG/L AS NA)	84110 2345- 2345- 20- 20- 20- 20- 20- 20- 20- 20- 20- 20	SONTU : PEHCENT	POTAS- SIU4+ DIS- SOLVED (MAZL AS K)
DEC . 15	∂ 78									
21 MAR • 1:	.050		280	41	72	24	61	1.6	32	4.5
27 JUN	.130	.06	540	390	140	45	74	1.4	53	8.3
12										44 m
03										
	(46 IE 45 • 1978	E SULF - DIS VED SOL /L (M)	5- 01 -VED SOL 5/L (19 504) 45	E+ DIS S= SOL /ED (MG /L AS	- ARSE VED DI /L SOL (UG Z) AS	5- 01 0/E0 50L 0/L (UG AS) AS	.VEO SOL IVL (UA	. NEO SOF NEO SOF	M. CORR - OIS VED SOL	ved /L
	1977	U 4:		.6			1000	•	10	-
JUN		_	· ··	-	~					
12. 0CT							100	••		
03.	•••					 1	400	~	10	
DA	(UG	S= h) VED SOL /L (UC	MANI MANI MESI MESI MANI MESI MANI MANI MANI MANI MANI MANI MANI MANI MANI MANI MANI MESI	E MICKI S DIS VEI' SOL VL (UG	- DI VED SOL VL (UU	S- DI VED SOL	IM. SEL IS= NIU IVED TOT	M. TUENTAL DI	OF SOLI	S= √ED ::IS K
0EC	• 1978	10	2	4 0	2	10	1 บ		505	•59
	+ 1979	130		30	-	20	5	-	_	•17
MUL	• • •	20		140					with t	
OCT							14	-		
03,	• • •					10		10		

WATER-QUALITY DATA FOR WELL HS-15, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMPER- ATURE (DEG C)	(C)ne	SPE- CIFIC CON- DUCT- AUCE (MICRO- MHOS)	PH (UNITS)	CARBON DIOXIDE DIS- SOLVED (MG/L AS CO2)	ALKA- LINITY (mg/L AS CACO3)	BICAR+ RUNATE (MG/L AS HCO3)	NITRO- GEN+ AMMONIA DIS- SOLVED (MG/L AS 11)	NITRO- GEN+ NO2+NO3 TIS- SOLVED (MS/L AS N)	PHOS- PHAIF. ORIGO. UIS- SOLVED (MOVE) 45 PO4)
JAN .	1979		osnue ·	469	7.3		170		1.3	1.3	.03
448 26		10.0			8.1		110			.16	•09
JUN											
13 OCT		11.0			9.1	1.8	110	140			
02	. 1500	13.0	0.5068	340	B • 0		130				
DATE	PHOS- PHORUS+ OIS- SOLVED (MG/L AS P)	PHOS- PHOPUS, OPTHO, UIS- SOLVED (MG/L AS P)		HARD- NESS+ NO ICAK- RO IATE (MBNL (MBNL (MCD3)	CALCIUM DIS- SOLVED (MG/L AS CACO3)	CALCIUM JIS- SOLVED (MIS/L AS CA)	MAGNE- SIUM, DIS- SULVED (MG/L AS MG)	SUDIUM+ DIS- SULVED (MG/L AS NA)	SONIUM AN- SORP- TION RATIO	SOD TUM PERCENT	POTAS- SIU*. DIS- SOLVET (No/L 45 K)
	1979										
11	150	•01	180	13	42	42	19	27	.9	24	6.3
25 JUN	• • • • • • • • • • • • • • • • • • • •	. U 3	140	34		33	15	5 5	.8	25	۷.5
13	•										
02											
DATE	CHEO- RIDE+ DIS- SOLVED (MG/L AS CE)	SULFATE 015- SOLVE: (1071- 45-304)	015- SALVEA (-67)	SILICA* 015- 50LVED 146VL 45 SILICA*	AGSFITC DIS- SOLVED (UG/L) AS AS)	HORON+ HIS= SOLYED (USZL AS H)	CADMIUM UTS= SOLVED (UGVL AS CD)	CHRO- MICH, DIS- SOLVED (JEVL AS CR)	COPPER. DIS- SOLVED (UGAL AS CU)	(80%- 015- 50L/E0 (UG/L 45 FE)	LEA-1+
JAN .	1979	4.6	• 7	11	2	1100	1	0	5	200	
MAR					2		•		3	300	5
35 25		+ Ó	.8	5.t		680		0		20	
13						610				120	
02	•	~=				300		10		~=	~-
	^\ S (915- 0 ALVEU 5 UG/L (15- OL/E0 50 UG/L (IUC. NE DES- C DEVEN SC JAZE (L	TE- NT 1944 S 155- PF 1575 TO 1676 (U	HOED NE FAL TO G/L (U	509 (LE→ CON (DM+ TUE (TAL () (G/L 5.)	STI= 0 	105. G 15. AMM LVFO D 0.15 Sn ER (**	15- 0 LVF0 50 G/L (0	CURY IS- LYEU GVL - MG)
	JAN . 19/9	150	5	30	9	••		277	•38	1.7	•0
	50 474	0	••	10	5			205			
	JUN 13	v	••		ı				•28		
	001		••	()	1,	1	٤				
	. •				•	-	-				

DATE	TIME	TEMPER- ATURE (DEG C)	AGENCY ANA+ LYZING SAMPLF (CODE NUMBER)	SPE- CIFIC CON- DUCT- ANCE (MTCRO- MHOS)	PH (UNITS)	CAPHON DIOXIDE DIS- SOLVED (MG/L AS CO2)	ALKA- LIMITY (MG/L AS CACO3)	RICAR- HONATE (MG/L AS HCU3)	NITRO- GEN+ NO2+NO3 DIS- SOLVED (MG/L AS N)	PHOS- PHATE: ORTHO: DIS- SOLVEU (MG/L AS PO4)
JAN • 1	979 1155		80020	1170	7.3		530		2.5	
MAR 27	1350	10.0	80020	520	7.1		180		1.2	.00
JUN 13	0900	13.0	80020	580	7.1	32	210	250		
02	1545	15.0	80020	850	7.0		330			
	[3.3	130"	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	530			300			
DATE	PHOSE PHOSUS: DISE SOLVED (MG/L AS P)	PHOS- PHOQUS+ ORTHO+ OIS- SOLVED (MG/L AS P)	HARD- UESS (MG/L AS CACO3)	HARD- NESS+ NONCAR- BONATE (MG/L CACO3)	CALCTUM DIS- SOLVED (MG/L AS CA)	MAGNE- SI'M+ OIS- SOLVEU (MG/L AS MG)	SONTUM. DIS- SOLVED (MGZL AS NA)	5001UM 20- 50HP- 110N 110H	SONTUN PERCENT	POTAS- SIJA+ DIS- SOLVED (MGZL AS K)
JAN . 1			500	0	93	63	72	1.4	23	9•1
12 MAR	.090	••	500	0						
27 JUN	-010	.00	230	53	52	25	33	.9	٤٤	3.v
13 OCT										
02		•-				~~				••
DATE,	CHLO+ RIDE+ DIS+ SOLVED (MG/L AS CL)	SULFATE DIS- SOLVED (MG/L AS SO4)	FLUO- RIDF+ DIS- SOLVED (MG/L AS F)	STEICA. DTS- SOLVED (MG/L AS SIO2)	ARSENIC DIS- SOLVED (U3/L AS AS)	BORON+ DIS- SOLVEU (UG/L AS B)	CADMIUM DIS- SOLVED (UG/L AS CD)	CHRO- MIUM+ DIS- SOLVED (UG/L AS CR)	CUPPED. 915- SOLVED (UG/I) AS CU)	(2000- 015- 50LVE.) (USZL AS FE)
JAN • 1	979 28	87	.5	23	1	470V	<1	0	8	4 ()
MAR 27	16	36	.6	16		2500		0		230
JUN 13		.,.				300				10
120						3300	••	10		
,5000								•		
DATE	LEAD+ DIS= SOLVED (UG/L AS P3)	MANGA- MESE+ DIS- SOLVED (HG/L AS MN)	NICKEL • OIS- OICKEL •	ZTNC+ DIS- SOLVED (HG/L AS ZN)	SELE+ NIUM+ OIS+ SOLVED (UC/L AS SE)	SELE- NIJM+ SUS- PENDED TOTAL (UG/L AS SE)	SELE- UTUM+ FOTAL (UG/L AS SE)	SOLIDS. SUM OF CONSIT- TUENTS. DIS- SOLVED (MGZL)	SULTOS+ DIS+ SOLVED (TONS PER AC-FT)	MERCURY OTS= SOLVED (US/L AS HO)
JAN . 1					-			•		
12 MAR	5	720	4	40	1	~	••	716	.÷1	• 0
27 JUN	•=	150	•-	10	27	••		348	.47	49 49
13 UCT		10			15			-		
02				10	6	1	7			

DATE JAN • 1' 11••• MAR 27••• JUN	1515 1400	TEMPER- ATURE (DEG C)	AGENCY ANA+ LYZING SAMPLF (CODE NUMBER) 80020	SPE- CIFIC CON- DUCT- ANCF (MICRO- MHOS) 2360	PH (UNITS) 7.3 7.3	CARBON DIOXIDE DIS- SOLVED (MG/L AS CU2)	1 KA- LINITY (MG/L AS CACO3) 580 310	BICAR-HOMATE (MG/LASHCU3)	NITRO- GEN+ NO2+NO3 DIS- SOLVED (MG/L AS N)	PHOS- PHATE: ORTHU: OIS- SULVED (MG/L AS PO4)
13 oct	9910	13.0	80020	1300	1.3	39	400	490		
02	1630	14.0	80020	1510	1.2		490			* •
DATE	PHOS- PHORUS, DIS- SOLVED (MG/L AS P)	PHOS- PHORUS. ORTHO. DIS- SOLVEU (MG/L AS P)	HADD- NESS (MG/L AS CACO3)	HARD- NESS: NONCAR- BONATE (MG/L CACO3)	CALCIUM OIS- SULVED (MGZL AS CA)	MAGNE- STUM, DIS- SOLVEU (MG/L AS MG)	SODIUM+ DIS+ SOLVED (MG/L AS NA)	SODIUM AD- SOMP- FIGN PATIO	SODIUM PERCENT	POTAS- STUM+ OTS- SOLVEU (MG/L AS K)
JAN , 1		۵۵	1100	560	26.0	1.20	160	2.3	75	1 υ
11 Mar	.090	•00	1100	560	260	120	160			
27 JUN	.020	.00	660	350	160	64	62	1.0	17	5.1
13							••			
02							•			
PATE	CHLO= RIDE+ DIS= SOLVED (16/L AS CL)	SULFATE DIS- SOLVED (MG/L AS SO4)	FLUO- RIDE- DIS- SOLVED (MG/L AS F)	SILICA. DIS- SOLVED (NG/L AS SIO2)	ARSENIC PIS- SOLVED (UG/L AS AS)	BORON: DIS- SOLVED (UG/L AS 3)	CADMIUM DIS- SOLVED (UG/L AS CU)	CHRO- MIUM+ DIS- SOLVED (UG/L AS CR)	COPPES+ 012- 50FAE-3 (ARVE 700 (ARVE)	IPO9+ DIS+ SOLVED (UG/L AS FE)
JAN . 1		0.00	,	1.6	2	4.30		0		1700
11 Mar	19	900	•5	15	2	490	v	0	0	1700
27 JUN	8.7	430	•5	12		340		0		90
13 OCT		••				640	••			30
92						550		20		
DAFE	LE40+ DIS- SOLVED (HG/L 45 PH)	MANGA- NESF+ DTS- SOLVED (UG/L AS MN)	ALCKEL * OIS+ OICKEL *	ZINC. SOLVED STINC.	SELE- NIUM. OIS- SOLVED (UG/L AS SE)	SELE- NIUM; SUS- PENDED TOTAL (UG/L AS SE)	SELE- NIUM. TOTAL (UG/L AS SE)	SOLIDS. SUM OF CONSTI- TUENTS. DIS- SOLVED (MG/L)	SOLIDS+ DIS- SOLVEO (TONS PER AC-FT)	SERCURY DIST SOLVED (UG/L AS Ho)
JAN + 1										
11	2	3600	13	30	ŋ		-	1860	2.53	• 1
27 Jun		560		20	7			960	1.31	
13	••	0.0		,	5					
02				ەب	1	i	2			

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DATE	TIME	TEMPER- ATURE (DEG C)	AGENCY ANA- LYZING SAMPLE (CODE NUMBER)	SPE- GIFIC CON- DHCT- ANCE (MICRO- MHOS)	He (ST14U)	CARBON DIOXIDE DIS- SOLVED (MG/L AS CJ2)	ALKA- LINITY (MG/L AS CACO3)	BICAR- BONATE (MG/L AS HCO3)	MITRO- GEN+ MOZ+NO3 DIS- SOLVFU (MG/L AS N)	PHOS- PHATE: ORTHO: JIS- SOLVED (MG/L AS PO4)
JAN . 1	·470									
11	1315		80020	415	8.0		150		.20	.09
MAR 27	1315	11.0	80020	450	7.8		140		1.3	•09
JUN 13 OCT	0340	13.0	90020	420	7.8	3.2	130	160		
03	1430	11.0	80020	400	7.7		130			
	PHOS- PHORUS, DIS- SOLVED	PHOS- PHORUS: ORTHO: 015- SOLVED	HARD= NESS (1467)	HARD- NESS+ NONCAR- BUNATE	CALCIUM OIS- SOLVED	MAGNE- SIUM• DIS- SOLVED	\$001UFF+ 015+ \$0LVF0	500 I UM AO- SU-P- I I UN		POTAS= SIJ4• DIS= SOLVEH
DATE	(:46/L 45 P)	(MG/L AS P)	45 C4C03)	(MG/L CACO3)	(MG/L AS CA)	(MG/L AS MG)	(AGZL AS NA)	PATIO	SODIUM PERCENT	(MG/L 45 ()
	-	43 F7	CACOST	ONG() 3)	MJ CAT	4307	~3 1 <i>11</i> 1.7		r GRGGM	-5 (/
JAN • 1: 11•••	979 •120	.03	140	0	31	14	38	1.4	37	5.1
21	•0=0	.03	200	22	43	23	26	• ರ	55	3."
14										
03										
1) 4 T E	CHLO- RIDE+ DIS- SOLVED (46/L AS CL)	SULFATE DIS- SOLVEU (MG/L 45 SO4)	FLUO- PIOF. DIS- SOLVED (MG/L AS F)	SILICA, DIS- SCLVED (MG/L AS SIO2)	ARSENIC DIS- SOLVED (UG/L AS AS)	HOPON+ DIS- SOLVEU (UG/L AS B)	CADHIUM DIS- SOLVED (UG/L AS CU)	CHRO- MIUH. DIS- SOLVEO (UG/L AS CR)	CORPER+ DTS+ SOLVED (UGZL AS CO)	IROJ• DIS= SOLVED (UGZL AS FE)
JAN , 19	979 16		, ,	1.2	2	1 200		0	2	0.0
MAR		42	1.1	13	3	1200	<1	0	S	90
27 JUN	9.7	48	.8	11		1100		0		10
13 oct			-		~~	600				30
03						730		0		
0476	LEAD+ DIS- SOLVED (UG/L AS PH)	MANGA- MESE+ DIS- SOLVEO (UG/L AS MN)	NICKEL+ DIS- SOLVED (UG/L AS NI)	ZTNC, DTS- SOLVED (HG/L AS ZN)	SELE- NIUM. DIS- SOLVED (UG/L AS SE)	SELE- NIUM, SUS- PERIDED TOTAL (UG/L AS SE)	SELE- HIGH. TOTAL (UG/L AS SE)	SOLIDS: SUM OF COMSTI- TUESTS: OIS- SOLVEO (4671)	SOLIDS+ DIS+ SOLVED (TONS PER AC-FT)	MERCURY DIST SOLVEU (UG/L AS HB)
JAN . 19										
11	979									
	979 8	500	5	10	2			253	.34	• 0
MAR 27		500 0	5 	10 10	2		~~	25 3 280	.34	•0
MAR	8									.0

WATER-QUALITY DATA FOR WELL FC-1, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	IINE	TEMPER- ATUME (DEG C)	tcan		FIC N- CT- CE C-YU-	ры 'IN[TS)	DIO	S- I VED J/L	ALKA LINIT (MG/ AS CACO	Y ACI		BICAR- HONATE (MS/L 4S HCO3)	CAR- HOTAT (467)	() 10 a E SU L ()	TRO- SEN+ 2+ND3 JIS- JUVEC (G/J)
DEC . 19		ه د		- -			,	•	•	e4 ,		100		0	1.7
21 MAR + 19		5.6			1410	7.3	1	.5	_	_	50	190			
27 JUN	0945	9.0) A00	20	1750	7.4				1	30				1.5
12	1345	13.0	800	20	1000	7.4	1	. 0	1	30		160			
03	0933	11.0	800	20	910	7,5			2	10				••	
DATE	PHOS- PHATE. ORTHO. DIS- SOLVED (MG/L AS PU4)	PHOS- PHORUS, DIS- SOLVEL (AG/L AS P)	015	5• U• на: U• че! D (мі	911 - 55 학 6/L 유 5	HARD- MESS+ ONCAR- ONATE (MG/L CACO3)	(14 G	VED	MAGNI SIU UIS- SOLVI (MG/II	M. SOD - UI' EN SUL'		SUPIUM AD- SUPP- FION BAFIO	SAUI!! PERCE	9 5 4 {-	1745- 1744 175- 1676 1676
DEC • 19	978 	.090			680	520	18	.0	55	,	59	1.0		16	4.5
MAR . 19		.080		05	490	750	24		5.5 5.8		33	1.9		24	1.0
JUN		-													
12 0CT 03				 										••	
DEC	RT OT S0 (4 lie as	5- 0 LVED 9 G/L 0	ULFATF 15- INLVE() MG/L I SO4)	FLUC+ RIDE. DIS- SOLYED (MGZL AS F)	STLTC 015- 50LV (1667) 45 5102	485 50 U L 50	SENIC (IS-)LVFO (GZL (-AS)	4046 919 5067 (JGA AS 6	- /Ευ /L	CAOMIDM DISH SULVEN (DGZL AS CU)	CHR(410) 015: 50LV (UG/ AS (4• C02 • 01 /E0 S 0	PED+ 5+ LVF() GZL C(I)	[RO3+ DIS+ SOLVED (JOY/L AS FE)	
MAH	1979														
JUN	ı	20	800	.2	19				100			0		360	
oct									100					10	
0.3) • • •	••			,			20	000			10			
ņ.	้อ ร อ (บ	AD. IS- LVEO S G/L (PANGA- PESE: DIS- OLVED UG/L UG/L	NTCMEL • OIS= SOLVEO (UGZL AS NT)	ZENC DES SOLVI GUSZI AS ZI	• NI - 0 En So L (0	LE+ UM+ IS- LVEO GVL	SELE NION SOS PENO TOTA (UG/ AS S). DEU NL 'L	SELE- NIUM. TUTAL (UGZL AS SE)	SOLIC SOM C COMS I TOENT DIS SOLV)F 50t 	IOS+ IS= LVFO OUS FR -FT)	ERCURY DIS- SULVEO (HGZL AS MG)	
	. 1978	2	H-)	4 .		30	4				1 4		1.39		
HAH	1979		190			3 n	3						2.00	•0	
JUN 12			511			- ••	2.			•-	• •				
0 C T	•••		••			1 0	3		t)	3					

WATER-QUALITY DATA FOR WELL FC-2, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMPER ATURE (DEG C	(C)	CY C! - C' !IG DU LE A' DE (MI	PE- IFIC IM- ICT- ICE (CPU- IOS)	PH (UNITS)	010	IS- LVED B/L	ALK LINI (MG AS CAC	TY 4 /L	CIPIFY (MG/L AS CACO3)	BTCAG BONA (MG, AS HCO.	TE CA /L 800 5 (4	.R- 4TE G/L CO3)	NITHU- GEN- NOZ+NO: DIS- SOL/EF (NG/L AS N)
DEC . 19	78														
21	1145	6.	0 80	020	1000	7.9		5.4		221	550	ä	270	U	1.7
MAR . 19	0912	10.	O HU	020	1250	7.6				230					2.6
JUN						-							•		
12	1355	13.	0 80	020	1400	7.6		8.0		160			200		
03	1000	11.	0 80	020	1360	7.6				300			••		
	PHOS- PHATE: ORTHO: DIS- SOLVED) 041 10 1 50LV	1)S. HO. НА S- ЧЕ	G/L	-HAPD- - YESS+ MONCAR- BONATE		vED	υί 50L	UM - 50 5+ 0 VEO 50	001UM• 015− 0150	SUPE) 4) -		POTAS- 510 1- 015- SOLVE
DATE	(MG/L AS PU4)	(ソウ/L AS P)	(MG 45		15 10031	(MG/L CACO3)	45	7/L CA)	(.∺i; A5		(MG/L AS NA)	PAT		THM CENT	(MG/L AS K)
0EC - 19		.03	0		440	220) 4	4	9	67	1	1.4	25	4.
MAR . 19	•09	. 03	n	.03	479	240	11	0	4	1	71	,	. 4	25	۶. د
JUN 12		•					-				•				
OCT			_												
03		-	•												
060 721 Man 27 Jun 12 001	19 10 10 10 10 10 10 10 10 10 10 10 10 10	S- LVED G/L	ULFATE DIS- 50LVED (MG/L 5 SU4) 310	FLUD- ATOF- OTS- SOLVES (MG/L AS F)	AS STO.	- 485 VED (VL S(() 2) 45	SF-ITC JIS- ILVEN IG/L 5 AS)	of Soc (UG AS	_	•	JM 41 - 01 ED 54 - (d	#0- 1)4. 5- EVFU G/C CR) 0	COPPED. UISH SOLVE) (UG/L AS CU)	01 SOL (U) 45	10 30 10
n a	0 \$3 (d	AD+ IS= LVEO :	MANGA- NESS. DIN- SOLVED (UG/L AS MO)	VIC≺EL • DIS+ SOLVED (UGZL AS VI)	11 50L (113	C• N. 5- L VFO Si /L (1	ELE- (U/4.) (S-)LVED JS/L S-SE)	PEN Tüt LUG	м• IS= IIEU A L	SFLE- NIUM- FOTAL (Ub/I AS SI	- 50M - 60V - 10E - 0	105. 0F 511- 215. 15- LVED 6/L)	SOLINS. TIS- SOLVED (TIMS PER AC-FT)	50£ (U6	(JHY 5= ,VEU (VL HG)
DEC	. 1978														
476	14/9	4	80 60	÷		20	7					725	.119		•••
いいへ	/••• !	**	10			10	7				••	179	1.46		
OCT	t									•					
0.3	3				•	10	4		U		4				

WATER-QUALITY DATA FOR WELL FC-3, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE		IME	TEMP ATU (DEG	HE	AGEN ANA LYZI SAMP (CU NU 1H	CY (5PE- CIFIC CON- DUCT- MMCE MICRO- MHOS)	•	PH [TS)	0108 0108 501	IS- LVED J/L	L [iv (vi (4:	3/L	BICA BONA CHE	ITE 5/L 15	CAH BOHA (MG	TF /L	GE NOZ+	S⇒ VED ∕L	PHOS PHAT OFFH UIS SULV (MG/	E. 10. ED
0EC +	10	500			90	020	1070		7.9		5.0		210		250		U	1	.6		
4AR . 27		930	1	0.5	80	020	1000	ı	7.6				210					ı	.5		09
JUN		405	,	3.0	90	020	1460		7.6		7.6		160		190						
12	_		_				_		•				-		_						
03	0.	745	1	1.0	40	050	1220		7.6				240								~
,	041 5	'PHO O I SO (M	0\$- 4(15, 5- LVED G/L P)	ე: 50 <u>L</u> 1	RUS• [40• [5•	HAUD- VESS (MG/L AS CACOS		ARD- ESS+ NCAR- NATE MG/L ACO3)) (i (i)? (i)?	CIUM S= LVED G/L CA)	(5(AGNE- SIUM• DIS- DLVED 4G/L S MG)	81 50L (M		50 T	110 40- 10N 10N 10N	SUD!		POTA SIC DIS SOLV (MG/	/4• /€0 ′L	
	EC .	1979																			
	21		.040			44	•0	230	1	00		46		71		1.5		54	4	• 1	
	27 UN		.020		. ú 3	46	0	530	1	00		45		69		1.4		?5	3		
	12					•															
	C! 0 3					•															
	DATE EC • :	9 T 50 (41 45	LO+ DE• S- LVED G/L CL)	o to Sou	.VE0 3/L	FLUO- 9 [0] 0 [5- 50] ve (467] AS F)	, ') - 'S [U (LTC4. IS- OLVED MG/L AS IO2)	(ا (ن)	ENIC IS- LVED G/L AS)	5: ()	DRON• DIS- DLVEU UG/L S H)	อ รถ เบ	MIUM (S+ LVFD G/L (D)	10 (U	HO- UM, S- LVED G/L CR)	(00	VFI)	I PO- DIS SOL- (UG) AS F	:- :E0 'L	
	21		45	3	20	•	,6	16		1		1800		1		U		6		50	
	AR		44	29	θu		, 7	16				1800				J				0	
	12											1700								10	
	CT 03					•						inuo	1			0					
	DATE	ก \$ล: (เ)	A!)+ IS- LVEN G/L P(I)	0.1 50((1)0	964+ 5F • 15= VED 3/L 4N)	NTCKFL OTS- SOLVE (UGAL 45 NT	n s	TNC+ DTS- OLVED UG/L S Z'I)	1 !A () () 2 () 2	LE- U4. IS- LVEO G/L SE)	V1	ELE- LIM. SUS- ENDED TAL JG/L S SE)	11 10 (3	LE# IM+ T\L G/L SE)	SUM CON TUE: D SOI	105. OF STI- VIS. IS- LVED U/L1	SOL (T) PE	S- VFD NS	MERCU DIS SOLV (UG/ AS H	ا- لای لا	
	EC . 1	1978																			
	21 AR ,	1474	4		290		5	30		4						736	1	•00		•0	
	27 UN				40	-		10		H						703		. 46			
	12				U	•				6											
O:	C T																				

WATER-QUALITY DATA FOR WELL FC-4, HAYDEN POWERPLANT, HAYDEN, COLO.

OATE	TIME	TEMP ATU (DEG	RE (C	NCY CT A= CO ING DU PLE AM DOE CHT	(え)=	РН	CARRO LIADIO DIS- SGLVE (VG/L SGO 28	E ALI 0 (M' 0 (A'	ITY 909 G/L () S	MG/L 60N	GI NO2- R- OI ATE SOI G/L ("'	N+ PH 10 LON4 15- 0 15- 0	05- ATE THO (S- LVE UVL PU4
DEC + 197	8 1045		5. 0 80	020	900	7.4	13		160	200	0 1	l.4	-
MAR , 197	9 1345	1	0.0 a	020	850	7.6	-	_	170		1	1.6	. (
JUN 12	1245	I	3.0 A	1020	900	7.6	7.	2	150	180			-
02	1500	-		1020	700	7.7	-		240				_
	PHO	05- HUS• 5-	PHOS= PHORUS. URTHO: DIS=	#&2 0- NESS	MARN- MESS. Moncar-	CALC: O[S-	rij u	MAGME- 1044 105-	SONTUM NIS-	SUFFIUM • • • • • • • • • • • • • • • • • • •		POTAS- Stum. OIS-	
	50	ĹV£ij G∕L	SOLVED	14616	HOMATE	SUL	15.7	SOLVED (15/L		POITA	500104	SOLVED (MG/L	
DAT		P)	AS P)	CACO3)	C4C73)	45 (-	45 4G)	AS MA		PEHCE IT	AS K)	
22.	1978	.01v		360	500	Be	3	35	50	1.1	٤۶	4.5	
36., JUN	••	.020	.00	380	510	98	!	36	50	1.1	55	5.0	
12.	••												
02.	••						• •				•-	**	
DATE	RI DI 50 (4	LO- 1)E• 5- LVEN 13/L	SULFATE OTS- SOLVEO (MG/L 45 SO+)	FLUO- RIGE. - 015- SOLVED (MSZL AS F)	STI TCA. DTS- SOLVED (MS/L AS STO2)	AHSE"	;= 'En '	9070N+ 915= 50EVED (UGZE AS p)	CADMIUM SOLVEI CUGNL CAGMIUM C	015-) SULVEO (UUZ)	COPPER. UTS- SOLVED (HBZ)_ AS CU)	THOM:	
	1978												
22 MAR	1979	45	230	10	14		1	440	1	. 0	3	v	
36. JUN	••	41	230	1.0	14			2300		• 0	••	40	
12.	••							220	••	•		10	
J2.	••		••					1900		• 0			
	ິງ \$ າ (ປ	AD. IS- LVED GZL	MANGA- NESE+ DIS- SOLVED (HG/L	NICKEL+ DIS+ SOLVED (UG/I	ZINC+ NIS- SALVEN (USAL	SELE NTO OTS SOLV	- - ED	SELE- NEUM+ SUS- PENDED TOTAL (UG/L	SELE- TUTAL TOTAL (DOVE	SOLIDS. SUM OF CONSTI- TUENTS. OTS- SOLVED	50f, t05+ 015+ 50EVEO (TONS PER	MEHCURY OTS= SOLVEO (UGVL	
DATE		- 04)	45 44)	AS VI)	AS 241	A5 3	F) .	45 SE1	45 SE	(HH/E)	AC-FT)	45 HB)	
22.	• 1973 • 1979	4	211	6	20		0			573	.78	• 0	
الان الان	• •		30		Su		S			581	. 79		
12	••		•0										
u2.	••				10		3	U	3				

WATER-QUALITY DATA FOR HS SEEP 1, HAYDEN POWERPLANT, HAYDEN, COLO.

OATE	117	1E	TEMPE ATUH (DEG	ATI LYZ R- SAH	NCY 4- 1세명 라니트 UDE UDE UDE	STRE FLI) INST TAME (CF	4.4- Δ.4-	SPF CIF CON DIC ANC (HIC	IC - T- F PO-	q IVU)	H TS)	CAR DIUA DI SOL (MG	IDE S= VEO /L	ALK LINT (MG AS CAC	/L /L	CA4- TYATE (MG/L AS	90 102 103 103 108	180- 180- 1803 18- 1/ED 3/L	PHOS PHAT URIT DIS SOLV (MG/ 45 PC	TE. HJ. S- VEN VL
JAN + 1	979																			
12	101	15	ŧ	3.0 d	0050	ε	.05	1	800		8.1				140		•	1.6	•	•00
27	158	20	6	o.o 8	0020	ε	.10	1	040		8.0				150		-	.91		.06
JUN 13	10	lυ	14	.0 9	0020	<	.01		650		8.3		1./		170	21	ט			
0CT 03	144	.5	12	2.0 4	0020	ε	.01		550		7.8				170					
	•																			
			o _H ns	• _																
	PHU!	5-	PHORU	-		HAR	n -			MAG	NE-			50 0	IUM		PO	TAS-	CHL) -
	PHOR		JATE		HO-	*1F S		CALC			U-10	SOUI) -			[U11 [S=	عد]د • کار	
	DIS:		SOLVE		SS G/L	40.1V		9 E S	vFD	10 50L		DIS SULV		5041 11:				VED	SOL	
	(MG)		(46)		s T	(**6		(46		(146		(116		RAT	IO SO	PUTOC		ラノレ	(MG/	
DATE	45 F	۱,	15 Þ	·) C4	Cu3}	CAC	02)	AS	CVI	45	'4G)	AS	AA)		P6	ERCEN	7 45	≺}	45 (IL)
JAN . 1										_			_							
12	• 6	140	•	.00	740		500	17	n	1		16			2.6	37		4.6	13	
27	• (200	•	.02	450		330	15	0	٤	5	4	5		.9	1	7	2.0	37	7
13 OCT															••	•	•			
03																	-			
۵ر)ATE	0 (1) 50(6) 45 (2)	FATE S- LVEU G/L SO4)	FLUO- RIDE: DIS- SOLVED (MG/L 4S F)	01 90 90 12 12	.ICA+ (S-)LVEO (GZ) (GZ)	50) (1)	= 11C 15= L VEO G/I. 45)	50L (110 AS	2010 (S=_VED 3/1_ H)	i) Si) (U	4104 15+ LVEU G/L CD)	(UG	4. - VED	COPPER SOLVE SOLVE COPPER SOLVE AS CO	ξυ ! -	1904. 015- 50LVF0 (UGZL 45 FF)	ັງ S ວເ	Ai). IS= LvEu S/L Ph)	
42	R			• '		1-		1				•				~			,	
	27 !N:	3	71	•4		9.4			1	1700				0	•	- •	10			
	3		••		•				1	1200					•		240			
	3				•				1	1100		••		10						
		7501 501 (1)	NGA+ SE+ IS+ LVED	MICKEL (** 15- ** SOLVE(** CHG/L) S((+	[NC+)TS= H_VEU H_VEU	11. U SU (1)	LF- UM+ IS+ LVED GZL	NIII Si PE Till (ibi	E- 14. 15- 2050 tal. 371.	77 70 (1)	LE- .14. TAL G/L	SOL	OF ITI- ITS. S- VED	SOLIDO O ES- SOLVI (TONO PEN	- รับ ! รั	OLIDS• OIS- SOLVED (TONS PER	501 (1):	CURY TS- LVED GZL	
ε)ATE	45	m-1)	45 11	45	5 771)	45	SEI	۸S	SE)	4S	SE)	(46	/L)	YAY)	AC-FT)	AS	7G)	
	N . 1	979	7	9	1	5		1					1	Зно		19	1.98		• 1)	
د ۰۹			3			10							•	736			1.00			
J.) N							4		~ -						50				
1)(30		•			9,							•					
4))3				•	1:)		5		U		۷			•	••				

WATER-QUALITY DATA FOR HS SEEP 2, HAYDEN POWERPLANT, HAYDEN, COLO.

OATE JAN - 197 12 MAR 27 JUN 13 OCT U3	TIME 9 1025 1530 1119 1515	1	EP- SI	ZING HPLE	STHEAM- FILD VI INST MI- FATEOUS (CFS) <-01 E-01	COP DUG - ANG - AN	FIC 4- 17- 180-	PH (TS) 8.1 6.2 8.2 7.3	010 (U	IS- LI' VED (1	ACT ACT	CAR- INATE MAYL AS ICO3)		N. PH NO3 0H S- 0 VED SUI /L (N	75- AIE. 15- 15- LVED 57L -00 -12
DAT	P)	P405+ HORUS+ DIS+ SOLVED (46/L AS P)	PHOS- PHORUS ORTHO OIS- SOLVED (MG/L AS P)	1+ HΔR(+ NFS) (11G))+ : 5 ::::::::::::::::::::::::::::::::::	HARN- IFSS. UNCAR- UNATE (MG/L CACO3)	CALCIUM OIS+ SULVED (MG/L AS CA)	\$ () \$0 (4)	GNET LUM* IST LVED GVL MG)	SODTUM OTS- SOLVED CNGVL AS NA	-4402 71148 71148	• • !		POTAS- SIUM: OIS- SOLVEO (167L AS K)	
12. Mah 27.		• • • • • • • • • • • • • • • • • • •	•0		10 300	25n 15n	120 68		26 31	42 88	2,	9	19	2.4 2.7	
JUN 13. OCT 03.	-			·-								· -			
1 A C	! !	CHLO- PIDE: DIS- SOLVED (1G/L AS CL)	SULFAI PIS+ SOLVE (MG/L AS SU4	010 0 50L) 0 60%)	(• (\$= (/E) (/L	ILICA. DIS- ENLVEN LYG/L AS E102)	ARSENTC DIST SULVED (UG/L AS AS)	1) \$0 (U	GVL LVED GVL GVL	CADMIU 1915+ 19102 1914 1914 1916 1916 1916 1916 1916 1916	015- 0 5 0EVF (UG/L	(1) (1) (1) (1) (1) (1) (1) (1) (1) (1)	VFD	TPON+ OTS+ SOLVEU (UOZL AS FE)	
12.	• 197	9 4 5	250		.8	14	1		1900	;	2	0	2	440	
MAR 27. Jun	-	42	250	:	1.0	11			1200		•	U		10	
13. OCT U3.			•						1300 1100			. -			
DAT	:	LEAD+ OIS- SALVED (UG/L AS PH)	MANGA NESE (DIS- SOLVE (HGZL AS #1	NICK! DIS- .0 SOL!	/FO 9	ZINC+ 015+ 50EVED (UGZE 15- 74)	SELE- NEUH+ DES- SULVEN (UG/L AS SE)	SF NI TO (U	LE- 11M+ TAL 67/L SE)	50L10S SIM OF CONSTI- TUENTS- DIS- SOLVEI (MG/L)	SOLIOS - 015- - 50LVE - 110NS	6 SOLI OI O SOL O CIO PE	5= VED '45 R	MERCURY DIST SOLVED LUGVL AS HG)	
NAU •51 Ham	• 1979	9 5	4	00	4	<3	,			61		•	. 23	• 0	
.15 VIIU				0 o		10	7			59			.81		
13. 0CT 03.							10		3	- .		. -			

WATER-QUALITY DATA FOR HS SEEP 3, HAYDEN POWERPLANT, HAYDEN, COLO.

OATE	TIME	TEMPERI ATURE (DEG C	(000)	STRI G FLO E INS E TAN	FAM= DA+ TAJ=	SPE- CIFIC COM- DUCT- ANCE AICHO- MHOS)	PH 2711/U)	0102 01 501 (:41	IS- LI' VED (BICAR- HONATE (MG/L AS HCO3)	MITRO- GEN+ NOZ+NO3 OIS- COLVED (MG/L AS N)	PHOS- PHATE. ORTHO. DIS- SOLVED (MS/L AS PO4)
1 + NAL	979 1120	6.	n 800	20	<.01	902	7.	3		160		.42	•00
MAR	0830					750	7.			160		.76	.00
71171 24	11030	4.1	U 800	20 (E.01	750	,.	0		100		•10	• 1,
13	1045	15.	0 400	20	<.01	590	7.	7	7.7	200	240		
03	1530	12.) 30a	20	<.01	720	7.	7	••	210			
DATE	PHOS- PHORUS. 0IS- SOLVEO (MG/L AS P)	PHOS- PHO9US OPTHO U[S- STLVED (MG/L AS P)		- NE9 NO90 L RON	3/L 3/L	ALCIUM DIS- SOLVED (MG/L AS CA)	MAGNE SIUM O15- SOLVE MG/L AS MG	+ \$001 01: 0 \$0EN	144+ 5- 50 /ED		SOD TUM PERCENT	POTAS- STUM+ DTS- SOLVED (MG/L AS K)	CHLU+ RIUE+ RIUE+ RIUE+ SOLVEN (MG/L AS CL)
JAN . I	979												
12	• 430	.00	3	00	140	68	31	;	>3	1.3	28	3.5	44
29	.010	.0	ے د	90	130	64	31	9	51	1.3	28	3,1	35
JUN 13	••		_	••			_	_				••	•
OCT			-				_						
03,				••								••	_
ט	91 90 (~	FATE S- LVED 1971	FLUN- 9102+ 015- 501/20 (46/1 45/F)	SILICA+ 0IS+ 50LVF0 (MGZL AS 5ID2)	##SEM D [S: SOLW (UGZ/ AS A)	- 1) En 50 L (U	15+ LVE0 67L	ADMIUM DIS- SOLVED (UG/L AS CD)	CHRN= MTUM+ DIS= SOLVE((JS/L AS CH)	(()(5)	veo Sol	IS~ 0 LVE0 50 G/L (U	(49 • (5 =)Even GVL Pp)
۵۱	N . 1979												
1	2 1	30	•6	15		1	2300	3	(•	2	310	5
	28 1	50	.6	11			2600		()	••	30	
	3	•-					300			-		40	
00	:T 3						2500	′	10	,		••	
	NE () 5()	IS-	1CKFL • 015= 50LVE0 (U3/L	21 iC+ nt5= 50LVF0 (US/L	SELE: UTOM OTS: SOLVI (USZI	- NI • 5 - PE ED TO	1050 Tal	SELE- NIUM+ TOTAL (JG/L	50LT054 504 0F CONSTI- THEMES 015- 50LVE	50L16 - 01: - 50L1 (10	S→ n VEO SO(VS (To	LVED D DNS SO	CUPY IS- LYED G/L
ŋ			45 41)	0°5 2A	45 3			AS SE	(46/L)			-	-1 3)
	N + 1979 2•••	20	4	6		3			511	l		.70	• (1
ز ز		50		10		6			450	•	•u1	.44	
1 00	3	50				1 .				•			
	13			υ		ı	a	1		•			

WATER-QUALITY DATA FOR HS SEEP 4, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMPI ATUI (NEG	AN LYZ EH+ SAN HE (C	ENCY NA+ I ING NALE SODE NAEN)	STREA FLOW INSTA TANEO (CFS	4- 0 	SPE- CIFIC CON- CON- CON- NOCE (ICRO- MOS)	1403	?H (TS)	CAR DIOX UI SGL (4G	10F 4 S- L1 VED 0	LKA- NTTY MIZ MIZ AS ACU3)	HCU 410 9104 9104	ITE I/L IS	NITR GEN NOZ+N TIS SOLV (MGZ	• 03 - ED L	PHOS+ PHATE, ORTHO. OIS- SULVER (MG/L AS PU4)
JAN . 19	79															_	
12 MAR	1045		7.0	30020	E٠	10	850		7.7			180			2.	1	.03
28 JUN	08+5	•	3.0 8	90050	٤.	01	770		7.5			160			1.	5	
13	1030	1	7.0	05008	٠,	01	725		7.8		5.8	190		230			
0CT	1525	14	2.0	02008	٤.	υl	880		7.8		••	220					
0ATE JAN • 15 12 4AR 28	PHOS- PHOKUS. DIS- SOLVED (MG/L AS P) 179 .U40	PHONE PHONE ORT OIT SOLIG (15)	US. HO. HA S- NE EO (M	240- 255 267L 25 2003) 290		+ C4	ALCIUM 115- FOLVED (MG/L 15 CA) 65	S I D I SOL (MG 4S	SNE+ (UM+ (S- LVED S/L MG)		UM. - S ED /L F	GONIUM AD- GOSP- TION PATIO 1.7	5001 PEHC			M. ED L	CHLO- RIDE. DIS- SOLVED (MGZL AS CL)
JUN 13																	
03																	
Jan 12 Mar 28 Jun 13 UC1	01 SC (* ATE 45 4 • 1979	FATE (Se) DLVEU (G/L) SO(4)	FLU0+ PIDE+ PIDE+ SOLVE (MG/L AS F)	SIC	5- 1780 576 5		i n En Sú	2400 2600 2600 2500	ა 50I (ს	MIUM IS- LVEU G/L CD)		(C) () () ()	PPEQ, IS- IS- IS- IS- IS- IS- IS- IS- IS- IS-	Soc Curs	S- VFD	LEAR DIC 50L 45	5- VE:) /L
17 17 17 17	ME E E E E E E E E E E E E E E E E E E	1 VGA- 1 SE + 0 I S- 0 I S- 0 I S- 10 VE 10 VE 1	NICKELS DIS- SOLVEI (UGVL AS NI)	() () SA ()) (AS	9C+ S= VF+) VF+) Z'41 G	SFLE- NTOM DIS- SOLVE (HGZL AS SE	- NI - PE - PC	LE- UM. SUS- SUFO OTAL SIGVL S SE)	N (1)	LE- IJM. TAL G/L SE)	SOLING SUM OF CONSTI TUENTS DIS- SOLVE (MG/L	50 50 50 50 50 50 50 50 50 50 50 50 50 5	LIDS.)IS- DLVEN FONS PER JAY) -15	57L (14) 0F	S- VFO NS	MERC. DIC SOLI (UG. AS)	5- VEU /L
	3	90		•			4				•	-					
a c 1	,		••	-	10		4	ı		5		-					

WATER-QUALITY DATA FOR HS SEEP 5, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMPER- ATURE (DEG C)	AGENCY ANA- LYZ 1 46 SAMPLE (COUE NUMBER)	STRFAM+ FLOW+ INSTAN+ TAMEOUS (CFS)	SPE- CIFIC CON- DUCT- ANCE (HICOO- MHOS)	P4 (UN[TS)	CAPHON DIOXIDE DIS- SOLVED (MG/L AS CO2)	ALKA- LINITY (MG/L AS CACO3)	HOLAR- HOLATE (MUNL) AS HCUJ)	NITRO- GEN. NUZ+NO3 DIS- SOLVED (MG/L AS N)	PHOS- PHATE: ORTHO: DIS- SOLVED (MG/L AS PO4)	PHOS= PHORUS: 015= SOLVED (MEZL AS P1
MAR , 1	979											
27.,.	1540	10.0	80020	F.Ol	440			160		1.6	.09	.030
JUN 13 OCT	1020	15.0	80020	<.01	460	7,9	3,8	100	190		••	
03	1500	11.0	A002i)	<.01	410	7.5		120				
DATE	PHOS- PHORUS, ORIHO, OIS- SOLVEO (*G/L AS P)	HA41)= NESS (MG/L AS CACO3)	HARD- NESS+ NONCAR- HONATE (MG/L CACO3)	CALCIUM DIS+ SULVEU (MG/L AS CA)	MAGNE- STUM. DIS- SOLVED (MG/L AS MG)	500 (UM. 0 (S- 50 L/ED (MG/L 4S (M4)	SUNIUM A0- SORP- TIOM PATIO	SODIUM PERCENT	POTAS- STUM+ DIS- SOLVED (MGZL AS K)	CHLO- HIGE+ DIS- SOLVED (MGZL AS CL)	SULFATE DIS- SOLVEU (MG/L AS SO4)	FLU0- PIUE+ UIS+ SOLVFU (MG/L 45 F)
MAH . 1	979											
27	.03	190	35	45	20	25	. 5	22	2.0	9.0	43	. 9
13							~-					
03		~-	***							••		
31AC	SILICA. DIS- SOLVED (MG/L AS S102)	90804• 015= 50LVE0 (467L 45 8)	CHRO- MIUS. DIS- SOLVED (UG/L 45 CR)	IROM. DIS= SOLVED (UGZL AS FE)	"ANGA- NESE+ DIS- SOLVED (HG/L AS MN)	ZINC+ 015= SOLVED (JGZL AS ZN)	SELE- NIUM+ DIS- SOLVEO (UG/L AS SE)	SELE- NIUM. SUS- PENDED TOTAL (UG/L AS SE)	SELE- HIUM. TOTAL (UGZL AS SE)	SULIDS, SUM OF COMSTI- TUEMTS, DIS- SOLVED (MGZL)	SOLIDS. DIS- SOLVED (TONS PER DAY)	SOL!DS+ 01S+ 00LYF0 (10)S 2C-F1)
MAR , 1	979											
27	11	1200	0	υ	0	10	8			251	.01	, 35
13 OCT	•	1100		10	10	•	7					
03		710	6)	~-		0	2	4	6			

WATER-QUALITY DATA FOR HS SEEP 6, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMPER- ATURE (DEG C)	AGENCY ANA- LYZING SAMPLE (CONE NUMBER)	STRFAM- FLOW+ INSTAN- TAMFOUS (CFS)	SPE- CTFTC CON- DHCT- A*ICE (41C90- MHOS)	PH (UNITS)	CARRON DIOXIDE DIS+ SOLVED (MG/L AS CO2)	ALKA- LINITY (MG/L AS CACO3)	BICAR- BUHATE (MIZE AS HCO3)	NTTRO- GEN+ NDZ+NO3 DIS- SOLVED (MGZI, AS N)	PHOS- PHATE, ORTHO, DIS- SOLVED (MG/L AS PO4)	PHOS= PHOPUS. DIS= SULVED (MG/L AS P)
MAR , 1												
8S NUL	0900	7.0	A0020	F.10	1700	7.8		130		1.5	.15	•060
13	1120	15.0	40020	E.10	1650	8.0	3.0	160	190		••	
03	1600	12.0	, 400S0	€.01	2690	7.8		160				
DATE	PHOS- PHOHUS, ORIMO, OIS- SOLVED (MG/L 45 P)	HARD- NESS (MG/L AS CACO3)	HAPI)- NESS+ NONCAR- HONATE (MG/L CACO3)	CALCTUM DIS- SOLVEU (MG/L AS CA)	HAGNE- STUM. DTS- SOLVED (MG/L AS MG)	SONTUM+ DIS= SOLVED (HG/L AS NA)	MUIDOR -CA -QRDZ -QUIT OITAR	SUD I UM PERCENT	POTAS- SIUM+ UIS- SOLVED (MG/L AS K)	CHLO- RIDE. DIS- SOLVED (MG/L AS CL)	SULFATE DIS- SOLVED (MG/L AS SO4)	FLU0- RIDE+ UTS- SOLVEU (MO/L AS F)
MAR . 1	a 7 9									,	•	
26	.05	600	→70	130	68	170	3.0	38	4.5	120	670	1.0
13		••									,	
03		**		••				••				
DATE	SILICA+ DIS+ SOLVED (MG/L AS SIO2)	80R04+ 0 (S= 5)LVED (JG/L AS 3)	CHRO- STUM. DIS- SOLVED (UG/L AS CR)	TRON. DIS- SOLVED (US/L AS FE)	MANGA- NESE+ DIS- SOLVED (UG/L AS M()	ZINC. DIS- SOLVED (UG/L AS ZN)	SELE- NIUM. DIS- SOLVED (UG/L AS SE)	SELE- NIHM. SUS- PENDED FOTAL (UG/L AS SE)	SELE+ NIUM+ TOTAL (UG/L AS SE)	SOLIDS: SUM OF CONSTI- TUENTS: DIS- SOLVED (MG/L)	50LI05+ 015- 50LVEU (10MS PER 04Y)	50L(05+ 015+ 50LVF) (10NS PEA aC-FT)
MAR . 1	979											
28 VUL	12	1400	10	10	10	20	۷	••		1260	. 34	1.71
13		1500		70	70		2					
03		1800	9			120	i	0	1			

WATER-QUALITY DATA FOR HS SEEP 7, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMPER∼ ATURE (DEG C)	AGENCY ANA- LYZING SAMPLE (CODE NUMMER)	STREAM- FLOW. INSTAM- TAMEOUS (CFS)	SPE- CIFIC CON- DUCT- ANCE CHICHO- MHOS)	P4 (UNITS)	CARHON 010XIDE 015- SOLVED (MGZL 4S CU2)	ALKA- LIVITY (MG/L AS CACOJ)	nICAR- HONATE (MUVL AS HCO3)	NITRO- GEN+ NUZ+NO3 DIS- SOLVED (MG/L AS N)	PHOSE PHATE: OFFHO: OISE SOLVED (MG/L AS PO4)	PRUS- SUPPER SOLVER (FIGAL AS, P)
MAR . 1		• •	22.270								.12	.020
85 PUL	a930	7.0	80020	E.01	1200	8.0		130		1.7	•16	
13 3CT	1100	16.0	80020	<.01	750	8.0	3.5	180	550			
03	1555	12.0	80020	<.01	800	7.8		97		••		
OATE	PHOS- PHORUS, OR FHO: OTS- SOLVED (MG/L AS P)	HARD- VESS- (MG/L AS C4C03)	MAPD= NESS+ NENCAR= NENCAR= HUNATE (MG/L CACO3)	CALCIUM DIS- SOLVED (MG/L AS CA)	MAGNE- SIIM. DIS- SOLVED (MG/L AS MG)	SOUIUM. DIS- SOLVEU (MG/L AS NA)	SODIUM AD= SORP= TIUN RATIO	SOD IUM PERCENT	POTAS- SIUM+ UIS- SULVEU (MG/L AS K)	CHLO- RINE+ DIS- SOLVED (MGZL AS CL)	SULFATE DIS- SULVED (MG/L AS SU4)	FLUD- F10E. U45- SULVFÜ (****A/L AS F)
MAP , 1	979											
7∩ <i>N</i> Sê	.04	510	380	120	52	58	1.3	52	3,5	75	410	1.0
13												
03					~-	~-		**	-		**	
04	SILI DIS SCL (MG AS	- HOR VED 01 VL SOL	/L (U	H+ IRO - 91 VEO SOL	N. NES S- OI VED SOL /L (116	(S= 0) VED SOL VL (OC	(S- UI .VED SUL .VL (UG	DM SEL IS- NIC VED FOT VL (UG	MAL DEN	OF SOLT	5- 01 VEO SUL MS (TC A PE	5= ven 55
MAR	1979											
85 7UL	• • •	4 6	9000	0	10	10	20	1		431	.02 1	•13
	3	••	251)		70	20	**	5			••	
	3	1	600	0			70	~-	4			

WATER-QUALITY DATA FOR HS SEEP 8, HAYDEN POWERPLANT, HAYDEN, COLO.

DATE	TIME	TEMPER ATURE (DEG C	AN LYZ - SAM	ING F IPLE IN IOUE TA	TREAM= 1 FLOW: 1 ISTAN= ANEOUS C	5PE- CIFIC CON- DUCT- ANCE MICRO- MHOS) (8	рн (21) и	CARBON DIOXIDE DIS- SOLVED (MG/L AS CO2)	LIN (M	ITY HOU G/L (: S	CAR- NO HATE HOZE S	GEN+ PI 2+NO3 OI DTS- ! OLVFD SI MGZL (!	105- 107E+ PTHO+ 6 DIS- DLVED 167L PO+)	PHOS- PHORUS. DIS- SOLVED (MGZL AS P)
MAR . 1979) 1945	3.	0 9	10020	E.01	1000	8.1			190		.23	.12	.030
JUN 13	1040	20.		10020	<.01	910	8.3	2.2		220	270		**	
	•••	2,4	.,				- • •				•			
OATE • • • • • • • • • • • • • • • • • • •	•	US. HO. H S- N En (/L	ARD- ESS MG/L AS ACO3) 470	HAKD- NESS: NESS: NONATE HOWATE (MG/L CACO3)	901.VEI (467L AS CA	015-) SOLVED (MG/L) AS MG)	50011. - 015 - 50Eve (107)	M+ A SUH U TI L RAT	ûм	SUDIUM PERCENT 21	POTAS- SIUM+ DIS- SOLVED (MG/L AS K)	RIDE, OIS- SOLVED (MG/L AS CL)	SULFA DIS- SOLVE (44-7) AS SO4	- -
DATE	FLUI PIDI PII SOL (MG	E, () S= S VFO (/L	LICA. IS- OLVED MG/L AS IDZ)	BORON: DIS- SOLVED (UG/L AS B)	nIS-	(11G/1_	(06/	• ZIA • DI ED SOL L (UG	S- VED	SELE- NIHM. DIS- SOLVED (UG/L AS SE)	SOLIDS+ SUM OF CONSTI- TUENTS+ DIS- SOLVED (MG/L)	SOLTOS+ OTS+ SULVED (TONS	SOLIOS 915- SOL75 (1)09 PEH AC-FI	<u> </u>
MAR .	-	e		224				30					_	
28 JUN 13		•5	11	2200 310				30 40	10	6	715	.02	• 6	• 7 • -
	•			310		- 40		7.0						

WATER-QUALITY DATA FOR GRAVEL PIT SEEP, HAYDEN POWERPLANT, HAYDEN, COLO.

OATE		TEMPER- ATURE (DEG C)	AGENCY ANA- LYZI IG SAMPLE (CONE MUMBER)	STHEAM- FLOW: INSTAM- TAMEOUS (CFS)	SPE- CIFIC CON- DUCT- ANCE (MICRO- MHOS)	PH (UNITS)	CARMON DIDXIDE DIS- SULVED (MG/L AS CO2)	ALKA- LINITY (MG/L AS CACO3)	BICAP- HONATE (MG/L AS HC03)	NITHO- GEN+ AMMONI* DIS- SOLVED (MG/L AS N)	NITRO- GEN+ NUZ+NO3 OIS- SOLVEO (MG/L AS N)
11	1445		80050		436	6.9		150		.06	• 0.6
27	1430	11.0	05008		440	8.0		150		•-	.13
13	0860	16.0	80020	₹.05	400	7,6	7.2	150	180		
02	1530	17.0	80020	€.05	436	7.5		100			
OATE	PHOS- PHATE, URTHO, OIS- SOLVEU (MG/L AS PU+)	PHOS- PHORUS. OIS- SOLVED (MG/L AS P)	PHOS- PHORUS. UNITHO. DIS- SOLVED (MG/L AS P)	HAPD- NESS (MG/L AS CACO3)	HARD- MESS+ MUNCAR- ROMATE (MG/L CACO3)	CALCIUM DIS- SOLVED (MG/L AS CACO3)	CALCIUM DIS- SULVED (MG/L AS (A)	MAGNE- SIUM+ OTS- SOLVEO (MG/L AS MG)	SOUTUM: DIS= SOLVED: (MG/L AS MA)	SUNTUM AD= SURP= ITON RATIO	SOI.IUM PEHCENT
JAN + 1	.74	.3+0	.24	160	13	44	44	13	22	٠,	22
4AR 27	•03	.010	.01	190	37		5v	15	22	.7	٠. ج
JUN 13		•									-
OCT							-	-		-	
02								••			
DATE	POTAS- SIUM. DIS- SOLVED (MG/L AS K)	CHLO= RIDE+ DIS= SOLVED (MGZL AS CL)	SULFATE DIS- SOLVED (AG/L AS SO4)	FLUO- PIDE: OIS- SOLYED (MG/L AS F)	STLTCA+ OTS- SOLVED (MG/L AS SIO2)	ARSENIC BIS- SOLVED (UG/L AS AS)	BURON+ UIS- SULVEU (UG/L AS d)	CAD 4104 D15- SOL /FO (UG/L AS CO)	CHPO= MILM+ DIS= SOLVED (UGVL AS CR)	COPPER. DIS- SOLVED (UG/L AS CU)	150%+ 015+ SULVED (UG/L AS Fr.)
JAN . 1	SIUM+ DIS- SOLVED (MG/L AS K)	RIDE+ DIS= SOLVED (MGZL AS CL)	013- 50EVED (-67E AS 504)	PIDE: DIS- SOLVED (MG/L AS F)	OTS- SOLVED (MG/L AS SIO2)	NIS- SOLVED (UG/L AS AS)	ÚIS- SÚLVEÚ (UGZL AS 8)	DIS- SOLVED (NAVL AS CO)	MIUN. PIS+ SOLVED (USVL AS CR)	SOLVED (UG/L 45 CU)	OTS- SOLVEO (OSZL AS Fr.)
JAN • 1 11	SIUM+ DIS- SOLVED (MG/L AS K)	RIDE. DIST SOLVED (MGZL AS CL)	015- 50LVED (-467L AS 50+)	PIDE+ DIS- SOLVED (MG/L AS F)	OTS- SOLVED (MG/L AS SIO2)	n (S- SOLVED (UG/L AS AS)	015- SOLVED (OG/L A5 d)	015- 50L/E0 (MA/L 45 CO)	MILING DIS- SOLVED (UGVL AS CR)	OTS- SOLVED (UG/L AS CU)	015- SOLVEO (US/L AS Fr.)
JAN , 1 11 MAR 27	SIUM+ DIS- SOLVED (MG/L AS K)	RIDE+ DIS= SOLVED (MGZL AS CL)	013- 50EVED (-67E AS 504)	PIDE: DIS- SOLVED (MG/L AS F)	OTS- SOLVED (MG/L AS SIO2)	NIS- SOLVED (UG/L AS AS)	015- SULVED (UG/L A5 d) 1700	DIS- SOLVED (NAVL AS CO)	MIUN. PIS+ SOLVED (USVL AS CR)	SOLVED (UG/L 45 CU)	015- SOLVED (VOZL AS Fr.) 450
JAN + 1 11 MAR 27 JUN 13	SIUM+ DIS- SOLVED (MG/L AS K)	STOE + DIS = SOLVED (MGZL AS CL)	015- 50LVED (-467L AS 50+)	PIDE+ DIS- SOLVED (MG/L AS F)	OTS- SOLVED (MG/L AS SIO2)	n (S- SOLVED (UG/L AS AS)	915- SOLVED (OG/L AS a) 1700 1100	015- 50L/E0 (MA/L 45 CO)	MIUN. DIS- SOLVED (UGVL AS CR)	OTS- SOLVED (UG/L AS CU)	015- SULVEO (US/L AS Fr.)
JAN , 1 11 MAR 27 JUN 13	SIUM. DIS- SOLVED (MG/L 45 K) .979 	910E+ 91S- 50LVED (MGZL AS CL) 9+1	015- 50LVED (-467L AS 50+)	PIDE+ DIS+ SOLVED (MG/L AS F)	0TS- 50LVED (MG/L 4S 5102)	A [S- SOLVED (UG/L AS AS)	015- SULVED (UG/L A5 d) 1700	015- 50L/E0 (MA/L 45 CO)	MILING DIS- SOLVED (UGVL AS CR)	OTS- SOLVED (UG/L AS CU)	015- SOLVED (VOZL AS Fr.) 450
JAN + 1 11 MAR 27 JUN 13	SIUM+ DIS- SOLVED (MG/L 45 K) 979 3.0	910E+ 91S- 50LVED (MGZL AS CL) 9+1	015- 50LVED (-467L AS 50+)	PIDE+ DIS+ SOLVED (MG/L AS F)	0TS- 50LVED (MG/L 4S 5102)	A [S- SOLVED (UG/L AS AS)	915- SOLVED (OG/L AS a) 1700 1100	015- 50L/F0 (MAZL 45 CO)	MIUN. DIS- SOLVED (UGVL AS CR)	OTS- SOLVED (UG/L AS CU)	015- SOLVE(1 (U57L) A5 Fr.) 450 130
JAN . 1 11 MAR 27 JUN 13 OCT 02 DATE JAN . 1	SIUM+ DIS- SOLVED (MG/L 45 K) 979 3.0 3.1 UEAU+ DIS- SOLVED (UG/L AS PH)	910E+ 015- 50LVED (MG/L AS CL) 9-1 17 MANGA- MESE+ 015- S0LVED (UG/L AS MM)	OIS- SOLVED (AGYL AS SO4) 46 56 56 VICKEL: DIS- SOLVED (USYL AS NI)	#IDE+ DIS+ SOLVED (MG/L AS F) .5 .9 ZINC+ DIS+ SOLVED (UG/L AS ZN)	575- 50LVED (MG/L 45 5102) 15 6.3 NIUM. DIS- SOLVED (JG/L 45 SE)	SELE- SULVED (UG/L AS AS) 1 SUS- PEWDED TOTAL (UG/L AS SE)	950 SELE- NIU4. TOTAL (US/L AS 81) 1700 1200 960 SELE- NIU4. TOTAL (US/L AS SE)	50L/ED (UG/L 45 CU) 3 50L/DS* 50M OF CONSTITUE=#15* 1015- 501 VED (MG/L)	SOLIDS+ DIS- SULVED (TONS PF9 AC-FT)	AMADNIA SOLVED (UG/L AS CU) O AMADNIA DIS- SOLVED (MG/L AS NM4)	MERCURY SOLVE SOLVE SOLVE SOLVE SOLVE SOLVE
JAN . 1 11 MAR 27 JUN 13 OCT 02 DATE JAN . 1 11 MAR	SIUM+ DIS- SOLVED (MG/L AS K) 979 3.0 3.1 LEAU+ DIS- SOLVED (UG/L AS PH)	9.1 9.1 17 MANGA- MESE: DIS- SOLVED (UGZL AS M4)	OIS- SOLVED (AGYL AS SO4) 46 56 VICKEL+ DIS- SOLVED (UJYL AS NI)	ZINC. 015- 50146/L 45 F) .5 .5 .5 .7 .7 ZINC. 015- 5014E0 (MSZL) AS ZN)	575- 50LVED (MG/L 45 5102) 15 6.3 NIUM- DIS- SOLVED (JJG/L 45 SE)	SELE- NIUM. SUS- PENDED TOTAL (UGZL AS AS)	950 SELE- NIUM. 1007L A5 d) 1709 1100 1200 960 SELE- NIUM. 101AL (UG/L A5 SE)	50LTDS- 50LTDS	SOLIDS+ DIS- SOLVED (TONS PFR AC-FT)	ATTRO- GEN- AMMONIA DIS- SOLVED (MG/L AS AMA)	015- SOLVED (UGZL AS FE) 450 130 210 **ERCURY DIS- SOLVED (UGZL AS MS)
JAN . 1 11 MAR 27 JUN 13 OCT 02 DATE JAN . 1 11 MAR 27 JUN	SIUM+ DIS- SOLVED (MG/L 45 K) 979 3.0 3.1 UEAU+ DIS- SOLVED (UG/L AS PH)	910E+ 015- 50LVED (MG/L AS CL) 9-1 17 MANGA- VESE+ 015- S0LVED (U//L AS MM) 1800 150	OIS- SOLVED (AGYL AS SO4) 46 56 56 VICKEL: DIS- SOLVED (USYL AS NI)	#IDE+ DIS+ SOLVED (MG/L AS F) .5 .9 ZINC+ DIS+ SOLVED (UG/L AS ZN)	575- 50LVED (MG/L 45 5102) 15 6.3 NTUM- DIS- SOLVED (UG/L 45 SE)	SELE- SULVED (UG/L AS AS) 1 SUS- PEWDED TOTAL (UG/L AS SE)	950 SELE- NIU4. TOTAL (US/L AS 81) 1700 1200 960 SELE- NIU4. TOTAL (US/L AS SE)	50L/ED (UG/L 45 CU) 3 50L/DS* 50M OF CONSTITUE=#15* 1015- 501 VED (MG/L)	SOLIDS+ DIS- SULVED (TONS PF9 AC-FT)	AMADNIA SOLVED (UG/L AS CU) O AMADNIA DIS- SOLVED (MG/L AS NM4)	MERCURY SOLVE SOLVE SOLVE SOLVE SOLVE SOLVE
JAN . 1 11 MAR 27 JUN 13 OCT 02 DATE JAN . 1 11 MAR 27	SIUM+ DIS- SOLVED (MG/L AS K) 979 3.0 3.1 LEAU+ DIS- SOLVED (UG/L AS PH)	9.1 9.1 17 MANGA- MESE: DIS- SOLVED (UGZL AS M4)	OIS- SOLVED (AGYL AS SO4) 46 56 VICKEL+ DIS- SOLVED (UJYL AS NI)	ZINC. 015- 50146/L 45 F) .5 .5 .5 .7 .7 ZINC. 015- 5014E0 (MSZL) AS ZN)	575- 50LVED (MG/L 45 5102) 15 6.3 NIUM- DIS- SOLVED (JJG/L 45 SE)	SELE- NIUM. SUS- PENDED TOTAL (UGZL AS AS)	950 SELE- NIUM. 1007L A5 d) 1709 1100 1200 960 SELE- NIUM. 101AL (UG/L A5 SE)	50LTDS- 50LTDS	SOLIDS+ DIS- SOLVED (TONS PFR AC-FT)	ATTRO- GEN- AMMONIA DIS- SOLVED (MG/L AS AMA)	015- SULVEU (UG/L A5 Fr.) 450 130 210 **ERCURY DIS- SULVEU (UG/L A5 H3)

DATE	TIME	TEMPER- ATUME (DEG C)	AGENCY ANA- LYZING SAMPLF (CODE NUMMER)	STREAM- FLOW. INSTAN- TANEOUS (CFS)	SPE- CIFIC CON- DUCT- ANCE (MICHO- MHOS)	PH (UNITS)	CARBON DIOXIDE DIS- SOLVED (MG/L 45 CO2)	ALKA- EINITY (MG/L AS CACO3)	RICAR- HONATE (MG/L AS HCO3)	NITRO- GEN, NO2+NO3 DIS- SOLVED (MG/L AS N)
JAN + 1						_		_		
11 MAR	1400		80020	• 26	1500	7.4		58		1.3
27	1500	8.0	80020	.82	375	8.1		120		.75
JUN 13	0930	13.0	80020	.26	390	8.0	2.4	120	150	
OCT			_							
92	1600	14.0	80050	.32	341	8.0		140		~-
DATE	PHOS- BHATE: ORTHO: D[S- SOLVED (MG/L AS PO4)	PHOS- PHOPUS, OIS- SOLVED (MG/L AS P)	PHOS- PHOSIC. ORTHO. OIS- SOLVED (MG/L AS P)	HARD- HESS (MG/L AS CACO3)	HARD- NE5S+ NONCAR- BONATE (MG/L CACOB)	CALCIUM DIS- SOLVED (MG/L AS CA)	MAGNÉ- STUM+ DTS- SOLVED (MG/L AS MG)	SODIUM, DIS- SOLVED (NG/L AS NA)	SOUTHWAD= SURP= TION- HATIO	SODIUM PERCENI
JAN . I	979									
11 MAR		. 070		510	549	160	48	94	1.7	c5
27	.15	.030	.05	160	40	35	17	23	• ಕ	24
JiJN 13										
02										
02									-	_ ,_
OATE	POTAS- STUM, DIS- SOLVED (MG/L AS K)	CHLO- PIDE+ DIS- SOLVED (MG/L 45 CL)	SULFATE DIS- SOLVED (MG/L AS SO4)	FLUO- PIDE+ DIS- SOLVED (MG/L AS F)	51L1C4+ 01S- 50LVED (467L 45 5102)	ARSENIC DIS- SOLVED (UG/L AS AS)	HOHON• DIS- SOLVED (UG/L AS 8)	CADMIHM DIS- SOLVED (DE/L AS (D)	CHRO- MTUM. UIS- SOLVED (UGZU AS CH)	COPPER DIS-SOLVEN (UGZL AS CU)
JAN . 1	979									
11 Mar	11	59	660	3.3	24	1	2700	1	Śη	3
27	1.4	15	58	.7	8.5		820		U	
13						••	1600			
0CT 02							1100		o	
-										
OATE	IRON+ DIS- SOLVED (UG/L AS FE)	LEAD+ DIS- SOLVED (UG/L AS PB)	MAMGA- NESE+ OTS- SOLVED (UG/L AS MN)	NICKEL+ DIS+ SOLVED (HGZL 45 NI)	ZINC+ DIS- SOLVED (UG/L AS ZN)	SELE- NIUM. DIS- SOLVED (UG/L AS SE)	SELET NTUM. TOTAL (UG/L AS SE)	SOLIDS. SUM OF COMSTI- THENTS. SULVED (MOVL)	SOLIDS+ DIS- SOLVED (TONS PER AC-FT)	MERCURY DIST SOLVED (UGZL AS HO)
JAN . 1	919									
11	15000	Ü	300	21	60	51		1120	1.52	• 1
27	0		U	0	10	10		237	. 32	
JUN 13	310		96	0		14				
92					0 86		7			

86

WATER-QUALITY DATA FOR SAGE CREEK ABOVE HAYDEN POWERPLANT, HAYDEN, COLO.

				AGENCY		SPE- CIFTC		CARHON			NITRO-	PHOS- PHATE •	PHUS
				AMA- LYZING	STYEAM+	COV- DUCT-		DIOXIDE -210	ALKA- LINITY	#ONATE	E00+504	08740. 015-	PHINDS PIS-
	T	IME	TENPEN-	SAMPLE (CODE	TAMEOUS	AMC=	PH	SOLVEÙ (MG/L	(MG/L AS	(M(+/L 45	50LVF1) (MG/L	50LVE0 (467L	30L75 (MGZ)
DATE	·	• •	(DEG C)	NUMBERT	(CFS)	MHOS)	(UNITS)	AS C02)	CACOSI	HCO3)	AS NI	45 PO41	à5 P)
MAR .	1979												
27 JUN	ı	510	7.5	80050	E3.0	4000	8.1		240		20	•58	.21
13	9	940	11.0	80020	E.75	2600	9*5	5.1	420	510		••	-
	РН	o s-											
		RUS,		HAHN-		MAGNE -		MU1602		P0115-	CHLO-		FLOO-
		THO. IS-	HARI)= NESS	NESS+	OIS+	STUM. DIS-	015-	^D= SORP=		SIUM. UIS-	H (DE. D (S=	SULFATE DIS=	PINE.
	SOL		(16/1	HONATE	SULVER	SOLVED	SOLVED	160%		SULVED	SOLVEO	SOLVED	SOLVE
		نار ن	45	(MG/L	(MB/L	(43/L	(467L	RATIO	SUDTUR	(MG/L	(46/)_	(MG/L	(~16/1_
DATE	45	P)	C4C33)	CACOJ)	45 CA)	45 46)	45 44)		PEPCENT	45 K)	AS CL)	45 504)	A5 F)
wan .	1979												
27 JUN		•19	1500	1300	160	270	540	5.0	44	7.9	59	23:10	•
13							••						-
										SOL 1	'ns•		
		SILIC		Crit			IGA+		SEL	E- SUM	OF SOLT		
		DIS		044 MI. 5- DIS									S-
		30E \ (MG)) (.VED SOL		(S~ 015 (VED) SQL			S- TUEN	/15• 50L 'S⇒ (fr		VEN MS
		AS	CUG								ν̃ευ `>̄ε		
0.4	ATE	5104	2) 45	H) A5	CP) AS	FE) AS	4N) 45	NI) AS	2N) 45	SE) (M)	5/L) 04	Y) AC-	FI)
	. 1	9/9											
27 JUN	7 V	i	7.5	190	10	40	70	0	30	120 3	1580 4	н.3 4	• 07
13	3			300		1 015	400	0		2			

WATER-QUALITY DATA FOR SAGE CREEK AT U.S. HIGHWAY 40, HAYDEN, COLO.

			AGENCY ANA- Ly71 4G	STHEAM-	SPE- CIFIC CON-		054AD UIX01G -21G	E ALKA			PHATE OHTHU	وزيدرية د
DATE	TIME	TEMPEH- ATURE (DEG C)	SAMPLE (CODE NUMBER)	INSTAN- TANFOUS (CFS)	ANCE (MICRO- MHOS)	PH (UNITS	SOLVE (MB/L	72 0 (AGN	(MoZI	SOLVE (MG/L) SOLVE (MG/L	O SCLVE (MG/L
447 . 1	.979											
8S NUL	0800	3.0	05008	E3.0	3300	7.	9 -	- 2	10	18	.3	7 .14
13 OCT	1300	22.0	90020	£1.0	1350	я,	0 4.	ن د	20 21	70 -		
03	1630	17.0	80020	E.50	450	ಕ.	5 -	- 15	. 00			-
	PHOS- PHORUS: OFTHO: OIS- SOLVED (4G/L	HARD- NESS (MG/L AS	HARD- NESS+ NONCAR- BONATE (MG/L	CALCIUM DIS- SOLVED (MG/L	MAGNE- STUM- DIS- SOLVED (MG/L	500109 015- 50LVED (46/L	SORP- TION RATIO	SODTU		4. RIDE. DIS- ED SOLVE	SULFAT DIS- D SOLVE (MG/L	015- U SULVE (%G/L
DATE	AS P)	(ECOAC)	CACOS	AS CA)	45 4G)	AS NA)	PEPCE	NT AS KI	AS CL	1 45 504) 45 F)
1 + 4AP 8S 8	•12	1200	960	140	200	410	5.	ے د	÷3 6,	,6 47	1800	•
13 oct						-		-				
03						-		- .	 .	. - -		
	S1L: 91:	5 - HO	ROV. MI	40− JM+ TRU	M. NES			INC.	SELE- SI NIUM: CO	DMSTI-	015-	LIUS. UIS-
			IS- UI: EVED SOI	-				015 - 01vED 5	DIS- TU SOLVED			01. VEN 10 15
	45			3/L (176				ひらくし	1067L S			>€H
A U	TE SI	151 72	H) AS	CH) AS	FE) AS	MN) 4	A (11/ 2	5 Z:N) A	AS SE)	(M/3/L)	Δ Υ) Δ	C-+ T)
	1979	6,9	260	10	40	60	0	20	110	54 5 0	8.55	3.74
			570		100	210			4			
03	١		130	0				70		90		.12

WATER-QUALITY DATA FOR YAMPA RIVER NEAR HAYDEN, COLO.

DATE	TIME	TEMP ATII (NEG	AN LYZ ER- SAM HE (C	ING F PLE IN ODE TA	PEAM= LOM+ STAU= NEOUS CES)	SPE- CIFI CON- DUCT AVCF (MICP MHOS	c - n-	PH ITS)		[7 4 7	ADIE APUE BM) A COH	GH R= 402 TE D VL 501 S (MI	EN PH/ • NO3 DR1 IS = 01 IYEO SOL 5/L (40	140 + P 15- 14ED 3/L	PHOS- HOPUS. HOPUS. HOPUS. (MOV!_ LMOV!_ LMOV!
12	1230		1.0	10020	172	3	10	7.4		100 -			.24	.09	.030
4AR 28	0910		2.5	05008	540	3	70	7 . B		100	•		.27	.12	• U 3··
JUN		,			7760	_	20	7.8		17		21			
13 oct	1315	1	5.0 9	0200	7760		80					21			
03	1625	1	5.0 A	10150	45	3	89	8.5		120					
DAT	PH(04 50L (-	HOS- NRUS+ RTHO+ VEO HG/L S P)	HAPI)= MESS (MG/L AS CACO3)	HARD- VEST NONCAR BOTATE (AGVL CACOS	CALC - DIS SOL (MG	YED	MAGNE- SIUM. UIS- SOLVED (MOZL AS MG)	(3)	5 - 720	500) Ar 5046 f (0 HAT))-)-	SOUTUM PERCENT	POTAS- STUM- OTS- SOLVED (MGZ), AS K)	CHL0: RIDE 015- SOL VI (MGZI AS CI	• ເບ -
12.	• 1979	.03	120) 1	9 3	1	10	á	21		.8	27	2.1	9	٠2
4AM 28•	• •	. 0 4	150	, 5	1 3	19	l J	ä	22		.8	24	2.5	e	. /
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oct															
03.	••			-	-	••								•	
9 aTi	01 5 0 (s	FATE (S=)LVED (G/L (SO4)	FLU0- -10E+ -0IS- -50LVE0 (MG/L -4S F)	SILTCA PIS= SOLVF MG/L AS SIO2)	445F 10 01 201 (113	S= VED	ROHON. DIS- SOLVED (UGZL AS B)	01 SUL (U)	1104 15- 1450 5/L CD)	CHP(111 m 015- 50LV (UG)	.∈0 .∠L	CUPPER. 015- SOLVED (UG/L 15 CU)	IPON+ NIS= SOLVED (UGVL AS FE)	LEAD DIS SOLV (UGZI AS P	• [i)
	, 1979														
12. Mah	• •	40	• 2	15		1	90		< 1		0	1	140		2
70/4 59 •	••	73	، ذ	9.	Ģ		60				0		30	•	
13. oct	••		**		-		70						149		
03.	••			-	-		70				10				
	NF C S/	MGA- ISE+ DIS- DIVED	NICKEL+ OIS- SOLVED (HBZL	015-	1 SOL	역. 역= V턴이	SELE- NIUM, SUS- PERIOFO TOTAL (UGZL	SFU NIS TOT	11	SOUTH SUM (CONST TUENT OTS SOUN)f [- S+	SOLIOS. DIS- SULVED LIONS PER	50L IDS+ (+IS+ 50L,VF() (+T0,NS+ +F(R)	MERCUR OIS- GUGNI	.o
1) 4 [E 14	4.1)	45 11)	45 ZN	1 45	SE)	AS SET		5E)	(MG)		UAY)	AC-FT)	AS HO	
V 4 12. Нам	• 1379 ••	40	4	,	3	0				1	90	88.2	•26	•	, (1
28. Jun	••	60	υ	1	ij	0				ž	230	さとと	.31	-	· -
13.	••	20		-	-	v								-	-
d.	••			. 6	11	1	a		U					-	-

WATER-QUALITY DATA FOR YAMPA RIVER AT HAYDEN, COLO.

DATE	тіме	TEMPE ATU- (DEG	A LY EH- SA PE (ENCY NA= ZING MPLE CODE MBER)	STREA FLOW [45]A [1460 (CFS	0 M= C(M= Ai M= Ai US (M	PE- IFIC)N- UCT- NCE LC40- HOS)	PH (UNÍTS	ALK1- LINITY (MG/L AS () CACO3)
OCT , 19									
03	1700	1	7.0	80020	٤1	00	370	8.	6 120
.)A		80P0N+ 015- 50LVED (UGZL AS R)	CHRO- MIUM. DIS- SOLVE (UG/L AS CR	n 50	(NC+)IS-)LVED)G/L (S ZM)	SELE- MIDM. MIS- SOLVE (UG/L AS SE.	NII SE 201 (U)	LE- UM, US- NOED TAL G/L SE)	SELE- HIUM. TOTAL (UG/L AS SE)
	. 197								
0.3	• • •	8ú	1	0	80	1)	9	0